GAS JOURNAL

LIGHT ∴ HEAT ∴ POWER

BYE-PRODUCTS.

Founded in 1849 as the "Journal of Gas Lighting."

VOL. CLXXXVIII.

OCTOBER TO DECEMBER, 1929.

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VOL. CLXXXVIII. No. 3463.] WEDNESDAY, OCTOBER 2, 1929 [81ST YEAR.

Editorial Notes.

Press the Button.

"OH, you just press the button" is the reply to-day of many a harassed father to the fiftieth question of his bright infant; and, in fact, the answer may in many instances not be far short of the mark. In a few years, it may well apply to gas production, for we think that the Dawsholm Works of the Glasgow Corporation shows how modern practice is taking care of the future. The plant there is certainly among the most interesting in this country. Consisting of continuous verticals and intermittent vertical chambers, it is amazingly flexible. There is provision for scientific coal preparation prior to carbonization; blending is given a full chance to demonstrate its merits; and part of the coke produced is treated in a dry cooling plant. Thus the combined plant has an exceptionally wide range of flexibility as regards gas output, choice of coal, quality of coke, and calorific value of gas.

There is another highly important feature of the Dawsholm plant, and that is the extent to which scientific control instruments have been employed to ensure steady and economical working. It is a "press-the-button" works from the inlet of the coal to the outlet of the gas and coke, and it constitutes an apt illustration that electrical equipment can be employed to advantage in the manufacture of two fuels which are destined to influence the domestic comfort and industrial prosperity of this country far more than the layman imagines. Most of the control instruments were described by Mr. J. F. Harrison in a paper before the North British Association of Gas Managers, a lengthy extract from which we published in the "JOURNAL" last week. The coal handling plant extends a distance of 240 ft. horizontally and 90 ft. vertically, and it is electrically driven throughout, and controlled from a control switch house. "The destination of the coal is decided, and the electrician is instructed which sequence is to be run. He then proceeds to the switch house and selects the required sequence by pressing a button." Pumps and other electrically driven plant not in sequence—the Sulzer plant, coke handling plants, telphers, transporter, and coal cranes—have separate circuits, and nearly all are controlled from the switch house.

To mention a few of the instruments, continuous automatic weighers and recorders of refinement and precision, operated by electricity, deal with coal and coke. Recorders chart the carbon dioxide and oxygen in the flue gases of the waste-heat boilers, and meters indicate the temperature of the outlet and inlet gases, and record it in the office. Pressure in the common producer gas main is recorded, as also is steam distribution throughout the plant, while three types of regulators ensure level-gauge conditions in the retort house. However, our purpose here is not to compile a list of these fascinating modern instruments, but to call attention to the development of the science of gas production as exemplified by the equipment at the Dawsholm Works. This equipment, by rendering data on every phase of the process available at all times, permits of close control and enables the management to secure the best results with the least expenditure, and in the knowledge that the primary aim of the industry—continuity of service—is safeguarded.

The Investor and the City.

SINCE the time of writing the article in last week's "JOURNAL," commenting upon the financial scandals which are shocking the City, there has been no lack of suggestions for securing in some measure the interests of investors. The steps taken by the London Stock Exchange Committee in the present crisis have caused satisfaction, as representing an earnest attempt to grapple with a serious position; but the investing public are hardly likely to be reassured by anything less than some plan by which the stable door is locked before the horse has gone.

The present moment, while feeling throughout the country is stirred, is the time to agitate for any practicable reforms which would render less likely a repetition of some of the troubles through which we are passing. It is in the direction of prevention that one would most like to see a move made; Nemesis appears to have little in the shape of material consolation to offer to the deluded. Probably the shareholder must always remain at a disadvantage, when investing in companies with whose business and management he has no opportunity of making himself acquainted; but a half-yearly, or even quarterly, progress circular, the compulsory publication within a certain limit of time of Directors' reports and statements of accounts (prepared so as to show the true position of the company, and not to hide it), and the immediate intimation by post to every shareholder of changes in the personnel of the Board, are no more than partners in a business may fairly lay claim to; and such information would in certain circumstances prove very helpful. These remarks, of course, have no relation to questions which have arisen over certain Corporation stock certificates, but are prompted by the collapse of various so-called "trust" companies, the true position of which outside shareholders are still anxious to learn.

In the smoothing-out of a tangle which is understood to involve many millions of pounds, numberless accountants will for a considerable period find themselves engaged; and while contemplating the object of their labours, one cannot help wondering whether their task would in any way have been simplified had a reform over which there has lately been much discussion already taken place. That is to say, had the distinctive numbering of shares been abolished. The matters now under investigation should surely be productive of strong argument on the one side or the other.

How Many Lives?

Some people who now are able to look back upon their youth, may recall the time when they envied the cat its reputation for having nine lives. It is true that, under more modern conditions, a cat might, with a little ill-luck, easily lose the whole nine of them in trying to cross a busy thoroughfare; but things were not always thus, and the lives apportioned to a cat used consequently to seem a goodly number. However one may regard the nine lives of the cat, they are demonstrably as nothing to the number enjoyed by the gas industry, whose early demise has been prophesied with unfailing regularity at intervals extending over the greater part of its career. With less than a hundred lives, it could not possibly have remained in existence until now. Yet it has done so, to the confusion of the "beneficiaries."

We note that once more indications have been perceived, by these self-same "beneficiaries," that "all is not well in the gas camp;" but we are greatly relieved to find that these "indications" are provided by nothing more serious than "the pathetic efforts of the gas industry to follow and approximate as closely as possible to electrical methods." This accusation against the gas industry, of pathetic efforts to copy electrical methods, may bring smiles to those who have noted the trend of development in connection with electric cookers; but it will be a good-humoured smile. The gas industry will adopt the best, wherever it may be found; and we have too high an opinion of the ability of those directing the fortunes of the electrical industry to imagine that they will do any different. So long as only the best is taken from the opposing armoury, there should be small reason to become alarmed over conditions in the "gas camp." It is, perhaps, only fair to add that on the present occasion our friends have apparently been buoyed-up by some "admission" that "gas is not making the progress it should in the lighting world," and by the proposal to inaugurate a Gas Lighting Service Bureau. Both "admission" and proposal, however, may well prove to be sources of strength, and not of weakness.

Shooting in Gas-Works.

We believe that this practice will become more common in the future, but that no legal action will be taken. It is, of course, absurd for the Law to step in when the guns used save many valuable therms, and therefore reflect favourably on the price at which gas can be sold; besides which, the guns are fired with blank cartridges, and they are destined not to destroy, but to build-up. Guns for hot patching of retorts and retort settings have been the subject of several patents recently, as our columns testify; and that cement shooting is a very "sound" practice is clearly shown by a paper which Mr. H. Pardoe contributed to the meeting of the Refractory Materials Section of the Ceramic Society on Sept. 18, an abstract of which appears on a later page of our issue to-day.

Mr. Pardoe appreciates the value of "bottle-tight" retorts, and he points out that this desirable condition can only be assured if some method of tightening-up is possible at a stage when thermal expansion has given a permanent "set" to the refractory construction—in other words, when the temperature of the plant is raised to working heats. "Cold patching" does not meet the situation, but "hot patching" does; and Mr. Pardoe's paper is concerned with the methods by which satisfactory hot patching may be achieved. These methods are: Spraying, paddle or peel patching, air guns, and detonator guns. The first is really a preventive against leaks, not a remedy of them; but it is extremely useful in that a highly refractory material working at a moderate temperature becomes very hard on the face when treated with a wash of suitable material, such hardening not penetrating into the brick to any appreciable extent, but forming a case-hardening effect which renders the surfaces almost immune from erosion. Nor is the second method—paddle patching—a satisfactory remedy for leakages in modern settings composed of highly silicious materials. Successfully to patch silica, it is essential to project the material with high velocity and pressure on to the objective, and literally to force the patching medium into the pores of the silica; otherwise there is no adhesion, and the patch falls away. To attempt silica with a peel at anything like working heats, states the author, is futile, for before the material can be got into position ready for pressing into the defective part, a dry and very hard "skin" forms on the surface of the patch, which obviously prevents adhesion. This is especially so in cases where a flame is impinging through a leak.

One must therefore "look to one's guns;" and regarding the two types—air gun and detonator gun—Mr. Pardoe leaves no doubt as to which he considers superior. The air gun, he says, is capable of good service, but is too heavy to operate with any degree of accuracy at great lengths in a vertical position; and as for detonator guns, those having a definite firing device (as distinct from the pattern in which the firing of the detonator takes place when the temperature of a bridge-piece rises sufficiently) are best. Of course, good guns are of little avail without efficient ammunition; and it is natural that Mr. Pardoe should consider the desirable characteristics of hot patching materials. In brief, these are: Adhesion upon contact with hot surfaces; a catalytic ingredient which will combine with the original material and form a bond at working heats, but with a long softening phase; a coarse-mesh ingredient pre-calcined in a proportion which produces a nearly constant degree of expansion of the whole; a compounded whole which will not reduce the refractoriness of the original, but will definitely reduce abrasion from the moving charge and the formation of slag on the refractory walls; a mixture which will carry the least possible water content to give the desired plasticity, thus reducing the tendency to steam off or cause spalling. The recipe for this mixture will be found in later columns.

The Truth of the Instalment Plan.

What is the actual truth about the instalment plan of doing business? At first we were told that the losses incurred were a negligible percentage; but the stern logic of figures has more recently been brought to bear upon this aspect of the matter, with less encouraging results. Then as to its popularity, people have been credited with the desire to acquire everything they can on the gradual payment system. Yet we find a writer who has been ascertaining the opinions of a number of typical housewives on the value of electricity for domestic purposes, telling his readers that some of them have a marked antipathy to the hire-purchase system of payment. One woman informed him that she "hated the idea of being saddled with a debt for a whole year;" and this feeling was shared by others. Another said that she had no intention of getting into the clutches of any firm that tried to entice customers with the instalment system. Quite a number, in fact, shared this suspicious attitude, as if they regarded the hire-purchase system as a clever trick to commit people to an expenditure that they could not afford. The writer referred to does not suggest that this antipathy to hire-purchase is general; but, at the same time, he is convinced that it is much more prevalent than is realized by the industry as a whole. This would seem to be a point in favour of simple hire; but it has to be remembered that the amounts involved in hire-purchase arrangements for electrical appliances would in most instances be greater than those needed to acquire domestic gas apparatus.

Hopes in the Irish Free State.

If the experience of the writer referred to above is anything like general, there may be disappointment in store for the Irish Free State Electricity Board, who, according to Dr. T. A. McLaughlin, their Managing Director, are hopeful of placing the electric washing machine within reach of the average household on the deferred payment system. He admitted that this is a high-priced machine; but standardization and mass purchase are to be relied upon to assist its popularity. The washer, of course, is

not the only electrical appliance which is high priced; and the deferred payment system will in all probability be invoked to aid the placing of vacuum cleaners, electric cookers, and electric fires. Therefore the opinion of the Irish housewife on the hire-purchase system may prove all-important. The possibilities of the Shannon scheme are, in its present stage, difficult to assess; there are factors not yet defined. For example, what does Dr. McLaughlin mean when referring to the "average household?" Taking the Free State through, will the "average household" require electric washing machines, electric irons, electric kettles, and electric vacuum cleaners? It is not expected to introduce "for the present" electric fires for all-day heating; but Dr. McLaughlin feels that the electric cooker is, in the next decade, going to supplant to a large degree the gas cooker. The "next decade" sounds some way off; and there is no certainty that the Board will be able permanently to act up to their intention to charge right through the Free State a rate of one penny per unit for domestic electricity.

"B.I.F." Joint Gas Conference.

Arrangements are now being made by the Institution of Gas Engineers, the Society of British Gas Industries, the British Commercial Gas Association, and the National Gas Council for the holding of a Joint Gas Conference at the British Industries Fair, Castle Bromwich, Birmingham, on Tuesday, Wednesday, and Thursday, Feb. 18, 19, and 20, 1930.

The Smethwick Tragedy.

Modern methods too often involve increased risk, or, at any rate, more serious results in case of accident. The appalling catastrophe at Smethwick about a month ago is a case in point. A building converted, after the present-day style, into tenements, occupied by several families, and provided with no adequate means of escape in the event of fire, was the scene of a conflagration of such intensity that within an incredibly short space of time no fewer than eleven people had met their deaths. Careful investigation into the cause followed, and expert opinion was that all circumstances pointed to the great probability of the fire having been started by the failure of a certain lead-covered electric wire which supplied the light to a back room on the ground floor, and ran back to a main switch in the theatre adjoining. The expert in question stated that there had been corrosion of the lead sheathing; and he added that he had only used lead-covered wire twice—the first time he had a fire, and the second time he was threatened with a law suit. He never intended to use it again. Lead-covered wire was not good enough for a building in which the public were assembled; nothing but steel tube was good enough. The Chief of the Birmingham Fire Brigade formed the opinion that the fire originated on the ground floor at the rear of the shop, and said that, while it was very difficult to come to a definite conclusion as to the origin, it was noticed that there was an inferior electric installation. It was quite possible that from that point the fire was caused.

The Written Word.

Quite recently, when referring to the approaching Association session, we ventured, with all humility, upon a few remarks in regard to the extent of the papers and addresses with which we anticipate having to deal. That we are not alone in experiencing an increasing difficulty in keeping pace with output, is evidenced by the following, from the pen of "Meteor," of the "Electrical Times," who is, of course, referring to the circumstances of another industry: "We may say that this problem of the deluge of society and institution papers and discussions is becoming so serious that we shall have something to say about it next week. Quantity, rather than quality, seems to rule the modern order of things; the plant of mass production is twisting its roots even round the fountain of knowledge."

Unemployment Insurance Act, 1929.

An article will be found on a later page of this issue on the subject of the Unemployment Insurance Act, 1929. This, although a short Act, is a rather important one, as it increases the share of the contribution of the State to the full contribution provided by State, employer, and employee. As it is the forerunner of a more comprehensive scheme to be introduced with the new year, everyone should be possessed of some knowledge of the finance of this fund. Considering the importance of the subject to every person, every trade, and every calling, and also to every taxpayer, this article should prove of general value. It not only gives a history of the finance of the fund, with interesting and instructive facts and figures, but, while doing so, reviews the new Act—the first of the new Parliament.

Value of Graphs in Business.

Commenting upon the fact that the well-known reluctance to use charts in dealing with facts and figures is beginning to die away, a correspondent to "The Times" Trade and Engineering Supplement declares that every month brings fresh converts, and the average man is beginning to appreciate the primary importance to himself of knowing what is happening in his business, and the fact that it is much easier to do this by means of two lines than by means of two columns of figures. All management, the writer points out, is based on comparison; and since the administrator can make certain which way he is going only by comparing what is happening at the moment with what happened in the past, or what he then had hoped would happen in the future, it is obvious that he must look about to find the simplest and most effective means of setting out this information in the clearest manner. It is intended to publish in "The Times" Trade Supplement a series of articles dealing with graphical methods in their simplest application to business matters; and administrators will probably find therein suggestions which will be of assistance to them in their daily work.

Overseas Trade.

A sign of the times is the raising by the National Union of Manufacturers of the question of the help given by the Government to British manufacturers seeking orders abroad. On behalf of the Union, a letter has been sent to the Foreign Secretary, in which, without wishing to interfere with the present constitution of the Department of Overseas Trade, the opinion is expressed that the Foreign Office and its ambassadors and other representatives abroad should take a more active part in promoting our trade interests, and make greater efforts to secure orders in foreign countries. It is felt that it would be a help in this direction if a special department were set up in the Foreign Office to deal entirely with trade matters.

FORTHCOMING ENGAGEMENTS.

[*Secretaries of Gas and Kindred Organizations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

Oct. 4.—NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.—Autumn meeting at Middlesbrough.

Oct. 4.—MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.—General meeting.

Oct. 5.—SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).—Meeting in Edinburgh.

Oct. 8.—ILLUMINATING ENGINEERING SOCIETY.—Meeting at 15, Savoy Street, W.C. 2, 6.30 p.m.

Oct. 9.—EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.—Autumn meeting at the Holborn Restaurant, W.C. 1, 2.30 p.m.

Oct. 11.—SOCIETY OF CHEMICAL INDUSTRY, CHEMICAL ENGINEERING GROUP.—Meeting in the Rooms of the Chemical Society, Burlington House, Piccadilly, W. 1, at 8.30 p.m. Paper on "Rationalization" by Mr. Davidson Pratt.

Oct. 17.—SOCIETY OF BRITISH GAS INDUSTRIES.—Meeting of Council in the afternoon.

Oct. 24-25.—INSTITUTE OF FUEL.—Annual conference at the Institution of Mechanical Engineers.

Oct. 28-30.—BRITISH COMMERCIAL GAS ASSOCIATION.—Annual Conference at Eastbourne.

Nov. 7.—MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—Autumn meeting.

Nov. 13-14.—INSTITUTION OF GAS ENGINEERS.—General meeting in London.

Nov. 20.—SOCIETY OF BRITISH GAS INDUSTRIES.—Autumn General Meeting, Hotel Metropole.

Nov. 22.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—General meeting at the Hotel Cecil, Strand, W.C., 2.15 p.m.

PERSONAL.

Mr. F. E. Smith, C.B., C.B.E., D.Sc., F.R.S., Director of Scientific Research at the Admiralty, has been appointed by His Majesty the King in Council to be Secretary to the Committee of the Privy Council for Scientific and Industrial Research, with effect from Oct. 1, on the resignation of Mr. H. T. Tizard, C.B., F.R.S.

Mr. F. W. Goodenough, C.B.E., has been elected President of the Incorporated Sales Managers' Association, in succession to Lord Leverhulme.

There was an interesting gathering at the Greenbank Gas-Works, Blackburn, on Sept. 25, to mark the departure of Mr. Alex. Jamieson, a member of the Corporation staff, who has been appointed Assistant Engineer and Manager of the Gas-Works at Coatbridge. Colleagues and workmen had contributed a gold wristlet watch, and this was handed to Mr. Jamieson by Mr. G. P. Mitchell, the Gas Engineer, who said he was sorry to part with a member of his staff who had proved very efficient during the three years he had been in Blackburn.

Mr. A. H. Aitken, Clerk to Accrington District Gas Board, discharged his duties for the last time on Sept. 26, having resigned a post he has held since the Board was formed. Alderman Rawson paid tribute to his faithful service. Not only had he been legal adviser, but he had a great deal to do with the purchase of the undertaking on behalf of Accrington Corporation and associated authorities. At the time, Mr. Aitken made a careful investigation of the undertaking's works, and, acting upon his advice, the Council purchased the concern in conjunction with Church, Clayton-le-Moors, Rishton, and Great Harwood. Mr. Aitken was with them in the dark days, and now in his retirement it must be some satisfaction to leave them financially sound.

Mr. J. R. Barrett has joined the sales staff of the Horstmann Gear Company, Ltd., and will be representing them in the Midlands.

OBITUARY.

Prof. W. H. Perkin, F.R.S., Waynflete Professor of Chemistry at Oxford, died on Sept. 17 at the age of 69 years. He was the eldest son of the late Sir William H. Perkin, the founder of the coal-tar dye industry. At the early age of thirty Prof. Perkin was made a Fellow of the Royal Society. In 1917 he and his brother, the late Dr. F. Mollwo Perkin, were elected Hon. Members of the Institution of Gas Engineers.

NOTES ON NEW BOOKS.

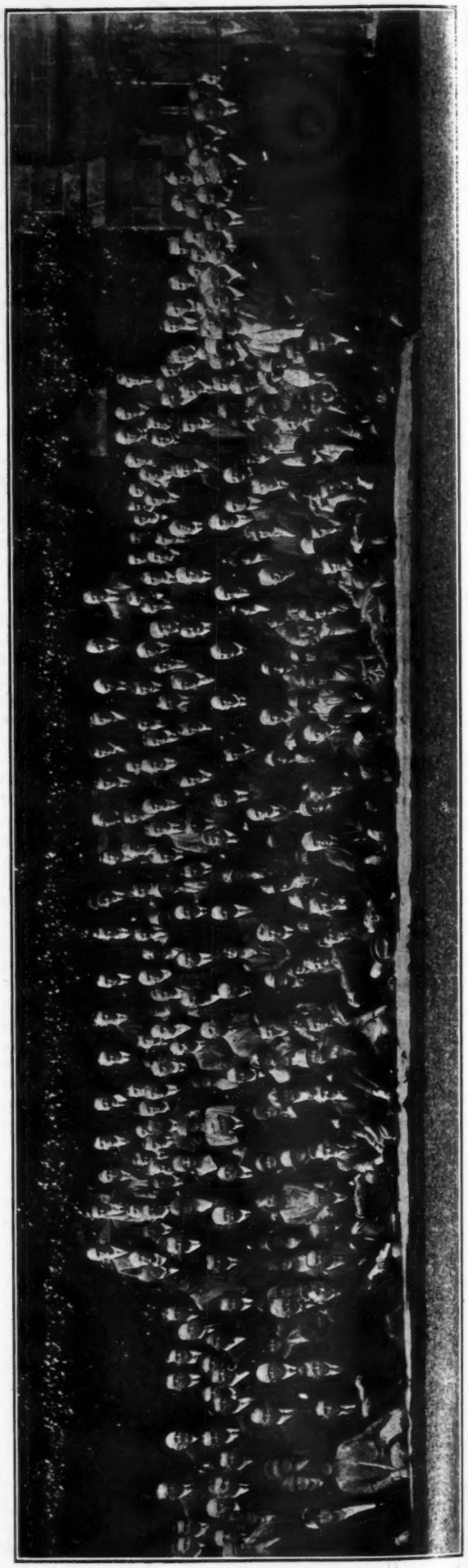
A NEW PITMAN PUBLICATION.

A complete library of modern practice, with simple explanation of the necessary theory, has been the aim of Sir Isaac Pitman & Sons, Ltd., in a new set of books about to be issued in the form of weekly parts, under the title of "Plumbing and Gasfitting." It is a matter for real appreciation that the worker of to-day is able to supplement his knowledge and skill, gained through his own daily work, by having placed before him a carefully compiled series of invaluable reference and instruction books of this nature. "Plumbing and Gasfitting" is an entirely new series, dealing with the different branches of plumbing, gasfitting, and sanitary engineering. In order that everyone concerned may be given an opportunity to acquire the complete series, the convenient method of publishing it in weekly parts at one shilling is being used. Since each part contains no fewer than 64 pages, we feel sure that the majority of our readers will regard this as a most simple way of obtaining the library.

Its up-to-date nature and its authoritativeness are guaranteed by the fact that it has been prepared under the editorship of Mr. Percy Manser, and by the names of the experts who have written the weekly parts, a list of which can be obtained, with other details of the publication, on application to Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, W.C. 2. It may be mentioned here that, among the contributors, are Messrs. F. W. Goodenough, C.B.E., W. Dieterichs, T. V. Garrud, and F. C. Smith.

Part I., which is before us, impresses us because of the workmanlike manner in which the subject of materials has been treated, the simplicity of the explanations, and the profusion of helpful illustrations. The whole work will obviously be of great practical assistance.

Eastern Counties Gas Managers' Association.—The autumn meeting of the Association will be held at the Holborn Restaurant, W.C. 1, on Wednesday, Oct. 9, under the Presidency of Mr. H. C. Smith, of Tottenham. The proceedings will commence at 2.30; and after the reading of a paper entitled "Some Notes, from a Distribution Standpoint, on the Transfer of Small Undertakings," by Mr. E. W. Bonsey, of London, and discussion thereon, the President-Elect, Mr. A. Gregory, of Harwich, will be introduced.



NORTH BRITISH ASSOCIATION AT ST. ANDREWS.

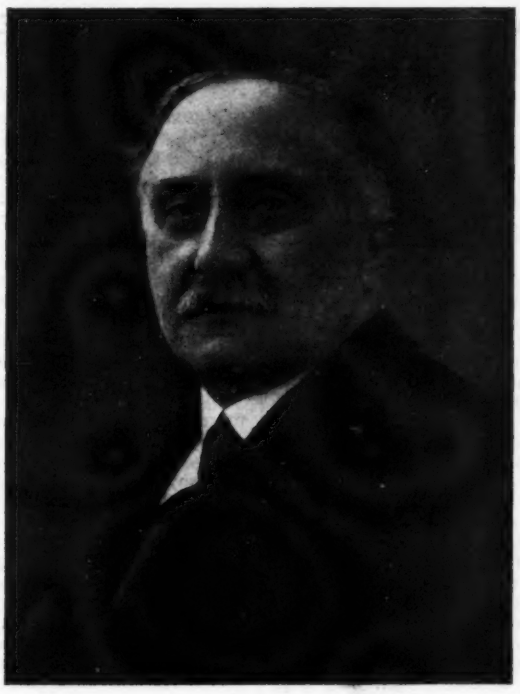
MR. THOMAS GLOVER'S RETIREMENT.

Intimation has already been made in the "JOURNAL" of the fact that Mr. Thomas Glover, C.B.E., M.Inst.C.E., Engineer of the Norwich Station of the British Gas Light Company, Ltd., had asked his Directors to allow him to retire at the end of last month on the completion of twenty-eight years' service. This seems a fitting moment to give some account of his career.

EARLY DAYS.

Mr. Glover is a Chartered Civil Engineer, and was President of the Institution of Gas Engineers in 1908. He has spent all his working days in gas concerns. Born in St. Helen's in 1862, after a technical training he was appointed Assistant Manager of the gas-works in his native town. In 1892 he filled a similar position at the Corporation Gas and Water Works at Carlisle. His first appointment as Manager was at West Bromwich, and in 1901 he went to the Norwich Station of the British Gas Light Company, Ltd., in succession to Mr. John Young. He took an early part in the development of the prepayment meter system, with its supplies of cookers and other appliances.

Glancing back, one realizes that Mr. Glover has played his part through a remarkable period in the development of gas supply; for he has held responsible positions for a good portion of that half-century during which gas has become a universal servant of the inhabitants of, at all events, urban areas. His record is one of which he has every reason to feel proud; as it is one that has earned the gratitude of the industry which he has served. The volumes of the "JOURNAL," which mirror the working lives of our leading gas engineers, bear eloquent testimony to the value of the services of Mr. Glover, whose greatest opportunity has been, of course, at Norwich, where gas has become almost the universal agent for cooking, water heating, &c. His aim has been to make the service of gas as perfect as possible by improving the status and quality of the outdoor staff, by the adoption of a good system of training gasfitters, and by the liberal use of inspectors and technical advisers to gas consumers. Rightly, the citizens have appreciated the efforts that have been made, and have admired the enterprise of the Company in the face of particularly keen electrical competition.



MR. THOMAS GLOVER, C.B.E., M.Inst.C.E.,
Late Engineer of the Norwich Station of the British Gas Light Company, Ltd.

ON THE WORKS.

But, when all is said and done, the perfection of gas supply begins at the works, where it has been Mr. Glover's aim to plan the manufacturing operations to give reliable results under scientific and technical control. The steady calorific value—now an every-day experience at Norwich—contrasts very favourably with the somewhat haphazard methods of bygone days. The carbonization of coal has been revolutionized, and the efficiency of the process raised to a high standard.

The extraction of sulphur from the gas in the process of purification has not infrequently shown a profit, though the Norwich Works are not geographically well situated for converting the sulphur into sulphuric acid, and making use of sulphuric acid for neutralizing the ammonia. For many years the material used for purification has been the returned oxide after burning at the Chemical Works; and the methods adopted for the employment of this material, mechanical means of dealing with the spent oxide, and the reduction of unprofitable labour, have resulted in bringing the cost of purification, taken over a number of years, to a zero figure. The abolition of naphthalene trouble and the better removal of tar by liquid purification are included in Mr. Glover's technical activities, and as showing the thoroughness of his work, it may be stated that the marketing of coke has received a good deal of attention, with the result that the whole of the production in Norwich is absorbed locally, and frequently the production is not equal to the demand.

The story of most, if not all, of this work has been revealed in the Presidential Addresses and papers from the pen of Mr. Glover, which have appeared in our pages from time to time.

THE WAR PERIOD.

The war brought upon Mr. Glover many new duties and responsibilities. He was given the supervision of a large area; his business being to stimulate the producton of bye-products of coal distillation for the use of the Ministry of Munitions and the Ministry of Agriculture. Under his direction, the British Gas Light Company put down plant to enable them to supply the Ministries with benzole and toluole for high power explosives, and with sulphate of ammonia to be used as manure for crops. He represented the gas industry on the Board of the Coal Controller, and held the position of Assistant Controller. This body performed highly important functions during the coal shortage that arose as a consequence of the war; and for his services he was awarded the C.B.E.

We find ourselves in hearty agreement with our friend in his opinion that well ordered and arranged works, with tidiness and cleanliness, have a good effect on the employees, and that these qualities make for efficiency and satisfaction to all who are engaged in the manufacture and distribution of gas. With these ideals in view, he has endeavoured to provide a works which are good to look at, and are a pleasure to operate. The better housing of the Company's employees and their re-

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creations (the provision of a bowling green and social hall) are among his latest interests.

As Lord Mayor.

The position of a gas engineer in full charge of an undertaking is a very responsible one, and his duties are sufficient to occupy almost the whole of his time when he is not sleeping; but Mr. Glover has found that it is possible for the engineer to derive a great deal of pleasure from the engineering, chemical, and physical processes which he controls. There is also much pleasure to be derived from the association with members of the staff (when they are good and efficient servants of the undertaking), and with many others who are indirectly associated through business and in other connections.

Beyond all this, however, Mr. Glover has somehow found time to serve his fellow citizens in other capacities. For many years he has taken a considerable part in the social and philanthropic life of the city, in which he enjoyed the hearty support of his wife. He was for a long period Chairman of the Committee of the Y.M.C.A., and has always taken a keen interest in the welfare of the young men of Norwich. He is a Past-President of the Science Gossip Club and of the Rotary Club, in which connection he delivered many lectures of a semi-scientific character. In 1925, he accepted an invitation to fill the responsible position of Lord Mayor of Norwich—a step which he would have found himself unable to take but for the generosity of the Board of the British Gas Light Company, who showed their sense of the importance of civic life by according him the necessary leisure from his professional duties to enable him to fulfil the manifold tasks which fell upon him as the Chief Citizen of Norwich. Indeed, Mr. Glover has always felt himself under a great debt of gratitude to the Chairmen and Members of the Boards of Directors and Committees, and his fellow officials, who have supported him in the work he has had to carry out.

A year later, to mark the completion of twenty-five years' service as Engineer and Manager at Norwich, and the appreciation of the staff and employees of the Company of the honour conferred upon him by his election as Lord Mayor, Mr. Glover was presented with a silver cigarette box, and he and the Lady Mayoress with a silver dessert service.

We decline to regard this as in any way representing a parting from one who has for so long been a friend of so many; but we hail the occasion as an opportunity of congratulating Mr. Glover upon good work well done, and of rejoicing that he is about to enjoy leisure that has been thoroughly well earned. That he will cease to take an interest in matters that have been through long years so near to his heart, we do not believe; and therefore we, as other friends, shall look forward with confidence to greeting him from time to time as of yore.

GAS STOCK AND SHARE MARKET.

[For Stock and Share List, see later page.]

Although a higher Bank Rate had been expected for some time, the announcement on Thursday last of the increase to 6½ p.ct., coming on the top of the "Hatry group" collapse, had a very depressing effect on the stock markets. There is, of course, no direct connection between the two matters, but there is little doubt that both of them will militate against the successful flotation of the anticipated industrial issues.

After the first shock of the Bank Rate announcement gilt-edged stocks settled down, and there was no depreciation of importance. Prices are easy, however, and would-be purchasers have excellent opportunities. Five p.ct. War Loan, with its accumulated interest, is very attractive at 101¼.

In the Industrial Market an atmosphere of uncertainty was still much in evidence, and prices, with the exception of a few isolated cases which moved for reasons peculiar to themselves, were on the low side, but there was no selling on a large scale.

The position in the Gas Market was not much better, and there were many falls in prices. On the Liverpool exchange only were there any improvements recorded in the ordinary stocks; Chester 5 p.ct. being marked up 1 point, and Liverpool 5 p.ct. ¼ point. On the other hand, among falls in the quotations, there was a drop of 5 points in Imperial Continental capital stock, 1s. in Primitiva ordinary shares, and 2 points in Croydon sliding-scale stock. There were some extremely low transaction prices—Gas Light ordinary at 17s. 6d., and 4 p.ct. preference at 56, Commercial ordinary at 93½, and South Metropolitan ordinary at 99.

The following transactions were recorded during the week:

Monday.—Bombay 17s. 6d., 18s., British 5 p.ct. deb. 96½, Croydon sliding-scale 105, Gas Light and Coke Company 17s. 6d., 17s. 9d., 17s. 10½d., 18s., 4 p.ct. pref. 72, 74, 5 p.ct. deb. 98½, Imperial Continental 385, 388, 390, 392, 395, 397, Metropolitan (of Melbourne) 5½ p.ct. deb. 98½, 99, Oriental 115, Primitiva 31s. 6d., 32s., 33s., 4 p.ct. cons. deb. 81, South Metropolitan 100, 100½, 100¾. Supplementary prices, Associated Gas and Electric "A" $71, 71¼.

Tuesday.—Croydon sliding-scale 107, max. div. 82½, 93, European 15½, 15¾, Gas Light and Coke 17s. 6d., 17s. 7½d., 17s. 9d., 17s. 10½d., 18s., 3 p.ct. deb. 56½, Imperial Continental 398, 399, 402, 405, 407, 408, 410, 412, 415, 416, 417, 418, Primitiva 33s. 9d., 4 p.ct. cons. deb. 81, 81½. Supplementary prices, East Surrey 6 p.ct. pref. 97½.

Wednesday.—Bournemouth "B" 12½, Gas Light and Coke 17s. 6d., 18s., 4 p.ct. pref. 73½, 74, Hong Kong and China 14½, Imperial Continental 407, 410, 411, 412, 415, 419, Sheffield 106½, South Metropolitan 99¾, 100, South Suburban 5 p.ct. 104, Tottenham 3½ p.ct. 107. Supplementary prices, Associated Gas and Electric "A" $72½, 73¾, Liverpool 5 p.ct. 94, Metropolitan (of Melbourne) £8 19s.

Thursday.—Bournemouth 5 p.ct. 12⅞, 13½, 7 p.ct. max. 12⅜, Commercial 94, Croydon max. div. 83, European 16, Gas Light and Coke 17s. 6d., 17s. 9d., 17s. 10½d., 18s., 3½ p.ct. max. 61, 62½, 4 p.ct. pref. 73, 3 p.ct. deb. 56½, Hong Kong and China 14½, Imperial Continental 393, 397, 399, 400, 402, 405, South Metropolitan 99, 99¾, 100, 3 p.ct. deb. 55. Supplementary prices, Associated $73, Tonbridge new 179, 179½.

Friday.—Bombay 17s. 6d., 17s. 9d., British 115¼, Commercial 93½, European 16⅛, Gas Light and Coke 17s. 6d., 17s. 9d., 17s. 10½d., 18s., 4 p.ct. pref. 71, 3 p.ct. deb. 56, Hong Kong and China 14¾, Imperial Continental 393, 394, 394½, 395, 396, 397, 398, 399, 400, 3½ p.ct. deb. 75, Primitiva 32s., South Metropolitan 99¾, 100½, 3 p.ct. deb. 54. Supplementary prices, Grays and Tilbury 7 p.ct. 11, Liverpool 5 p.ct. 93½.

Money was as usual more plentiful at the end of the week. Rates were naturally higher, and old day-to-day loans commanded from 5½ p.ct. down to 5¼ p.ct., while new accommodation was obtainable towards the close at 5 p.ct. The Treasury Bill average rate also showed a substantial increase at £6 2s. 4·53d. p.ct., but this rate was 13s. 5¼d. p.ct. only above the previous week's average.

Considerable disappointment was felt in the Foreign Exchange movements, particularly in the Paris rate, which finished with a decline of 6 points on the previous day at 123.81. Most of the Continental rates moved against sterling—Belgas to 34.86¾; Pesetas to 32.77½; Dutch florins to 12.08½; and German reichsmarks to 20.35¾. The exception was Italian lire, which were cheaper at 92.70.

Silver was a weak market, the cash prices falling ¼d. to 23 15/16d. per oz.; while Gold remained unaltered at 84s. 11½d. per oz.

The Bank Rate is 6½ p.ct., to which it was raised from 5½ p.ct. on Sept. 26. The Banks' deposit rate is 4½ p.ct., and the deposit rates of the Discount Houses are 4½ p.ct. at call and 4¾ p.ct. at notice.

Troubles of the Miners' Unions.—Attention is devoted to the important subject of the falling off in the membership of trade unions by the Chief Registrar of Friendly Societies in his report for 1928. This decline, of course, began with the general strike of 1926, and was continued during the following year. The net loss of membership among the unions of the mining and quarrying group during 1926-27 amounted to 199,000, or about one-fourth of the membership at the beginning of 1926. The South Wales Miners' Federation lost during those two years 56,000 out of 129,000 members, the Yorkshire Mine Workers' Association 48,000 out of 164,000, and the Nottinghamshire Miners' Association 18,000, or more than half its membership. Other heavy losses during the two years were: Derbyshire Miners' Association, 18,000; Durham Miners' Association, 18,000; Lancashire and Cheshire Miners' Federation, 12,500; and Warwickshire Miners' Association, 6500. Two other large unions which showed considerable decreases during 1926 regained some of their lost membership in 1927. These were the Yorkshire Mine Workers' Association, which regained 32,000 of its loss of 80,000 in 1926, and the Nottinghamshire Miners' Association, which regained 6600 of its loss of 25,000. During 1927 six non-political unions of miners were registered, and at the end of the year had obtained 23,000 members, all of whom were in all probability previously members of the older unions.

Mr. Blundell's Paper on Verticals for Small Works.—Mr. Andrew Thomson, Gas Engineer to the Inverness Corporation, writes to inform us that, in his paper before the Cumberland and Westmorland Gas Managers' Association (see "Journal" for Sept. 25), Mr. J. E. Blundell gave the annual make of the Inverness Gas-Works as 67 million c.ft. Actually it is 160 millions.

RESEARCH AT THE "A.G.A." LABORATORY.

By R. M. CONNER, Director, Testing Laboratory.

[From the American Gas Association Monthly.]

Where the giant mergers now under way in the gas industry will stop, and what their effect will be on the future of our business, are problems inviting the attention of every far-sighted gas engineer. While these activities will doubtless effect certain economies in operation, they will at the same time introduce new operating difficulties which must be satisfactorily met and solved. The American Gas Association's Committee on Engineering and Economic Survey of the Gas Industry, functioning largely through its different Sub-Committees of the Technical Section, is endeavouring to anticipate these new developments, and, through various research agencies, place in our engineers' hands sufficient information to meet and solve them successfully.

The Association's Laboratory, in conjunction with its appliance testing programme, has under way three major research investigations which, when completed, should prove of great value to the gas business. Undoubtedly, one of the most important of these studies is that being conducted on mixed gases. This work is supervised by a Committee headed by F. C. Weber, Assistant Vice-President of the Brooklyn Union Gas Company. The term "mixed gas research," unfortunately, is somewhat of a misnomer. Common kinds of manufactured gases are composed of about the same components, varying only in their proportions. Consequently, this work could be more accurately termed "An Investigation to Determine the Effects on Utilization caused by Variations in the Physical and Chemical Components of City Gases."

With new natural gas fields being discovered yearly and large quantities of this gas being transported hundreds of miles to our great industrial centres, it seems possible that the present supply of gas might be changed even in such large centres of population as Chicago and New York. Many of the large middle-western cities are already being served with natural gas. Transmission mains of 500 miles or more are becoming quite common, and it is only logical to assume that, before long, practically every large industrial centre in the West will be supplied, at least partially, with this kind of gas.

It would also seem logical to assume that, inasmuch as natural gas is a very satisfactory fuel, and in view of the fact that it can be piped such great distances readily, it would not be long before we should expect the demise of many manufactured gas plants. In the writer's opinion, however, this will never generally take place, for three reasons: First, the fuel requirements of the country are increasing at such a rapid rate that the supply of natural gas will probably always prove inadequate; secondly, there will always be certain industries which produce as a bye-product a very satisfactory gas; and thirdly, it doubtless will be found economically impractical to pump and distribute a high gravity gas beyond certain predetermined distances.

It is likely that many of the small and more or less obsolete manufactured gas plants will be abandoned. As a matter of fact, this is already taking place, and is especially probable where such plants are located near large natural gas fields or larger and more efficient manufactured gas plants. A more likely development, however, is that the majority of modern manufactured gas plants will be remodelled to augment a supply of natural gas where available. Some of the probable uses for such plants will be cracking refinery oil gases and natural gas, and the production of low gravity, low heating value manufactured gases high in free hydrogen content.

As the nature of our supply becomes more varied, its utilization will require a more flexible gas. Natural gas and manufactured gases of extremely high hydrocarbon content can be made much more flexible by adding free hydrogen. Hydrogen, fortunately, also compensates for inerts by increasing the rate of flame propagation and offsetting the increased primary air injection caused by a heavier mixture. Consequently, we may expect the production of large quantities of this gas in the future. It is now being made experimentally without the production of objectionable quantities of carbon by injecting mixtures of steam and natural gas through a heated bed of coke in the usual type of water gas set.

Theories governing the successful mixing of gases are the foundation of a rather complex art which the laboratory is endeavouring to simplify and co-ordinate in such a manner that they can be readily applied by any practical gas engineer. From present indications, many ideas now existing regarding the allowable percentage of inerts and minimum acceptable heating values are subject to revision. It is a fact that under certain conditions, at least, rather large percentages of inerts are advantageous. Low heating value gases, if composed of the proper constituents, often make a very satisfactory fuel. Industrial applications appear to be subject to the greatest restrictions. In light of what has been said, it appears probable that most city gases of the future will be a mixture of many different kinds of commercial gases, of which some type of natural gas will doubtless form a high percentage of the base load.

While the encouragement of water heating, refrigeration, house cooling, and certain kinds of industrial applications will improve our load curves, it is too much to expect that we shall ever entirely eliminate our winter months' peaks. This statement is best borne out by the progress which house heating is making all over the country. Consequently, a base load of natural and/or some manufactured gas will doubtless have to be augmented by blue gas, carburetted water gas, refinery oil gas, or cracked natural gas. Such practices will result in changes in specific gravity, heating value, and, what is more important, chemical composition. Under these conditions, the Association's mixed gas research findings should prove exceedingly valuable.

One of the latest and perhaps most interesting studies to be initiated is the Association's new investigation of propane and butane. The initial objective is to determine the usefulness of such gases as enriching agents for lean types of manufactured gas, interchangeability of such mixtures with natural gas, and their value for straight carburetting purposes. It has already been proved, in a practical way at least, that "greased air," or air enriched with propane, can be used satisfactorily to replace the product of some types of small manufactured gas plants or in communities where a supply of city gas is not available. This pre-supposes, of course, that appliances are properly adjusted to operate on such a fuel. It will be the Laboratory's function to determine in an experimental way what the practical limits for such mixtures are, also to investigate the mechanics of vaporizing these gases, and their tendencies to condense under various conditions of temperature and pressure. It is possible that later this work may lead to experiments in reforming or cracking natural and refinery oil gases.

Coincident with the appliance approval requirement work, the Laboratory is also conducting about fifteen separate investigations for the purpose of obtaining fundamental data on the performance of certain types of domestic gas appliances and their accessories. This investigation should result in many improvements in our present gas-burning equipment, and also be of assistance to the manufacturer in a general way in bringing out new ideas. Furthermore, the Laboratory Managing Committee at its last meeting approved the conduct of certain types of research work for manufacturers, such activities

SOME OF THE APPLIANCES USED IN MIXED GAS RESEARCH.

to be paid for at actual cost, including such overhead as might logically be assigned to work of this nature. Since it is understood that this work will not be for the purpose of extending any approval, the manufacturer will be required to agree not to publish or use in a commercial way any of the results obtained. It is apparent that a number of manufacturers will eventually take advantage of this new service.

Standardization of Pipe Joints.

For a good many years there has been an obvious lack of standardization in types of construction and the method of making up cast-iron bell and spigot pipe joints. While this problem, as a general rule, is of greater interest to the manufactured than the natural gas man, it is certain eventually to become of importance to all. When a manufactured gas property is converted over to natural gas, one of the most trying problems is that of keeping leakage within reasonable limits, particularly if the company is serving stripped natural gas. The Association, at the recommendation of the Pipe Joint Research Committee, headed by O. S. Hagerman, of the American Light and Traction Company, has assigned this problem to the Association's Testing Laboratory. Though this investigation has only recently been initiated, it gives every promise of developing some very usful and beneficial results.

The abundant supplies of natural gas which are being made available so rapidly to large centres of population indicate that the day is not far distant when this kind of gas, augmented by some satisfactory type of manufactured gas, will become the generally accepted fuel where available. These developments, along with the large quantities of bye-product gases that are being made available, should greatly improve the economic position of our industry and hasten the day when gas will become the universal fuel. With such transitions, of course, will come numerous operating difficulties which must be met and solved by our engineers. It is hoped by the Laboratory Managing Committee that the "A. G. A." Laboratory will become a logical research centre for the gas industry, and that in this position it will not only effect marked improvement in our utilization equipment, but also become an important factor in successfully meeting the problems of the operating gas engineer.

THE CONTINENTAL POSITION REGARDING LARGE COKING PLANTS AND LARGE GAS-WORKS.

By Dr. Ing. Oswald Peischer.

[Contributed to Wirtschafts-Rundschau "Gas und Wasser," and reprinted from Vol. 1, No. 1, of "Koppers Review."]

The processes for carbonizing coal have been improved from time to time until they have reached the present high level of scientific development. Economic reasons have spurred engineers to reduce prime costs and have also compelled both coking plants and gas-works to concentrate their activities upon large central units rather than to dissipate them in a greater number of small units.

In accordance with the original wording of the German Collieries Syndicate Agreement, each colliery was given an annual coke quota of 100,000 tons for each of the mines in operation. This resulted in the erection of a large number of small coking plants with generally about 60 ovens per plant at each pit.

The position, however, was fundamentally changed by the new Syndicate Agreement, dated April 30, 1925, in accordance with which each pit now receives a coke quota based upon the amount of small coal made, which is generally up to 50 p.ct. of the coal quota. It is now only necessary for a colliery company to prove that it is able to produce the requisite quantity of coke in order to be allotted the maximum quota.

The greater latitude thus allowed in regard to the quantity of coke produced has contributed largely to the realization of the endeavours which have been made to rationalize the coking plants. During recent years, a considerable number of new coking plants has been erected in the Ruhr district, among them some of very large capacity, consisting of more than one battery of ovens, each battery comprising between 60 and 65 ovens. About 50 p.ct. of the total coke produced in Germany is made in these new plants; a corresponding number of old plants having been closed.

Prior to the year 1917, coking plants were operated largely by hand labour. For a plant producing 1000 tons of coke per 24 hours, 159 workmen were required for the operation of the ovens; the capacity per man was 5·1 tons of coke, corresponding to 6·4 tons of coal per 24 hours. After the year 1917, mechanical coke quenching and loading came into favour, and ovens were constructed of larger dimensions; in consequence, the number of workmen required to operate coking plants was reduced to 43 men per 1000 tons of coke produced per 24 hours. The capacity per man was, therefore, 23 tons of coke, corresponding approximately to 29 tons of coal daily.

A capacity of 2300 tons of coke per 24 hours can be secured by one set of machinery dealing with the throughput from 120 ovens. But this can only be secured at plants consisting of high-capacity coke ovens furnished with self-sealing oven doors, with mechanical door manipulating machines, and with specially effective operating machines. For the production of 2300 tons of coke per day in modern plants only 34 men are required, corresponding to a coke production of 67 tons per man per day, equivalent to a throughput of coal of 83·5 tons in 24 hours.

The tendency to combine a number of smaller plants into large-capacity installations is not confined to the coking industry, but is also to be found in the gas industry, where small installations have combined to supply several companies, and have erected works for the purpose, or in some cases have combined with the gas-works of the nearest large town. Such works are styled "grouped" gas-works.

The initial development of carbonization for gas manufacture proceeded upon different lines from that of bye-product coking plant, since gas engineers have necessarily laid stress upon gas production and not upon coke production. For this reason, up to the year 1907, the most noticeable development lay in the direction of reducing operating charges by the use of retorts of a more efficient design for the purpose of gas production, but no alteration was made to the shape of the retort. Not

until the year 1907 was a half-hearted attempt made to imitate the chamber type of coke oven by the conversion of the inclined retort into an inclined chamber oven.

The year 1909 saw the coke oven as used hitherto at coking plants adopted for use in the manufacture of town gas, but modified in design to employ producer gas for heating, as is customary in gas-works. From this time onward, this construction has been largely adopted by gas-works of a sufficient size. The extent of this development has been such that, at the present time, the plant to be found at the larger gas-works and at the larger coking plants shows scarcely any difference.

The preparation of coal used in coke ovens has received special attention. It has been recognized that the properties of coke are primarily dependent upon the condition of the coal from which it was produced, and that, furthermore, it is possible to influence the quality of the coke by suitable mixture of various coals. At all German coking plants and gas-works coal crushing and mixing plants are installed for the preparation of the coals, in order that the coking properties can be modified by admixture of inferior coking coals with others possessing good coking qualities. Such installations are deemed of particular value for gas-works, since, by grinding and mixing the coal, the ash content is more evenly distributed throughout the coke.

The two branches of the coal carbonization industry which have for many decades dealt with the same raw material, but with different objects in view, have in the past used different systems of carbonization. These systems have been independently developed, and were generally considered the best to produce the desired result. Pressure of economic necessity, however, has compelled both industries to abandon the policy of carbonizing in a number of isolated plants of small capacity, and has led to the inception of a new policy whereby several such plants are combined, in order to concentrate upon large central installations which enable them to secure the advantages attached to large-scale operation.

It is noteworthy that, on the Continent, the policy of the owners both of coke ovens and of gas-works has now converged, so that the same policy is being pursued in both industries.

IMPROVED AIR-GAS RATIO APPARATUS.

By CRANDALL Z. ROSECRANS, Leeds and Northrup Company, Philadelphia, Pa.

[Paper before the Division of Gas and Fuel Chemistry of the American Chemical Society.]

A gas analysis apparatus of the thermal conductivity type is described, particularly designed for measurements of ratios of air to fuel gas, where the fuel gas may be of any composition. The apparatus is also adaptable for general gas laboratory work, where concentrations of known gases are to be determined. It consists of a thermal conductivity cell mounted in a constant-temperature block controlled by a bimetallic thermostat, and an improved Wheatstone bridge gas analysis circuit.

The apparatus to be described is for the determination of the volume percentage of any one gas or mixture of gases in air or in any single gas. It operates on the well-known thermal conductivity principle, described by Palmer and Weaver[1],* and is a modification and improvement of the original Bureau of Standards device. While the thermal conductivity method for gas analysis is widely used, a brief description of the fundamental theory will be given here.

Gases differ markedly in their ability to conduct heat. If the conductivity of air is taken as unity, conductivities of other gases range from that of carbon bisulphide vapour at 0·284 to that of hydrogen at 6·95. Gaseous mixtures, of course, have conductivities which depend on their constituents and the relative amounts of each constituent. Now, if a fine wire is supported in a tube and heated by an electrical current, practically all of the heat will be lost by conduction through the gas. Thus the equilibrium temperature of the wire will depend on the thermal conductivity of the gas. By making the wire of platinum, or other material with a substantial temperature coefficient of electrical resistance, it is possible to measure the wire temperature by electrical means. Hence the thermal conductivity of the gas surrounding the wire can be determined in relation to some standard gas, such as air.

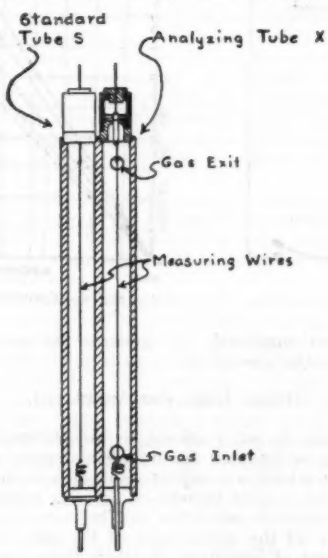


Fig. 1.—Thermal Gas Analysis Cell.

DESCRIPTION OF APPARATUS.

A thermal gas-analysis cell is shown in fig. 1. It consists of a brass block in which a $\frac{3}{8}$-in. (0·95-cm.) hole is drilled. Mounted axially in this hole is a platinum wire, 0·002 in. (0·005 mm.), which is kept stretched by a small helical spring at the lower end. The wire is electrically connected to the block at the lower end and is insulated at the top by a glass-platinum seal. The wire is heated to a temperature between 100° and 200° C. by electrical energy; substantially all the heat loss from the wire takes place by conduction through the gas.

A complete gas cell consists of two such tubes both drilled in the same block. One tube is sealed up with dry air (over P_2O_5) as a standard. The other tube has connections through which the unknown gas to be analyzed can be admitted.

The simple gas-analysis circuit in fig. 2 illustrates the method of measurement. *S* is the standard (sealed) wire and *X* the analyzing wire. *A* and *B* are resistances of zero temperature coefficient. *K* is a slide wire which can be adjusted to balance the Wheatstone bridge, the balance point being shown by the galvanometer *G*. A 4·5-volt battery supplies energy to heat the wires. Assuming that the two wires *S* and *X* are identical in resistance and in thermal environment, with dry air contained in both tubes, a balance point will be obtained at the mid-point of the slide wire. Now, if the air in the tube *X* is replaced by a gas of different thermal conductivity, the contact on the slide wire *K* must be moved to a different point to rebalance the bridge. Thus readings on the scale attached to the slide wire *K*, after proper calibration, would be functions of the gas conductivity, and hence of the concentrations of the unknown gas.

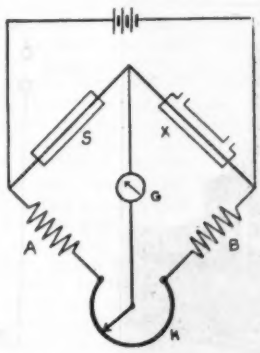


Fig. 2.—Gas Analysis Circuit.

Since the thermal conductivities of various gases change at different rates with temperature, it is necessary to maintain the gas-analysis cell at constant temperature, within limits fixed by the accuracy of measurement desired. This particular apparatus embodies a small bi-metallic strip thermostat, combined with an electrical heater. These two devices, together with the thermal gas cell are contained in a single heavy block

* Numbers refer to literature cited at end of article.

of metal which, by the action of the thermostat, is kept at 35° ± 0·4° C. Fig. 3 shows the construction of the thermostatic block, adapted from a design of the Bureau of Standards.

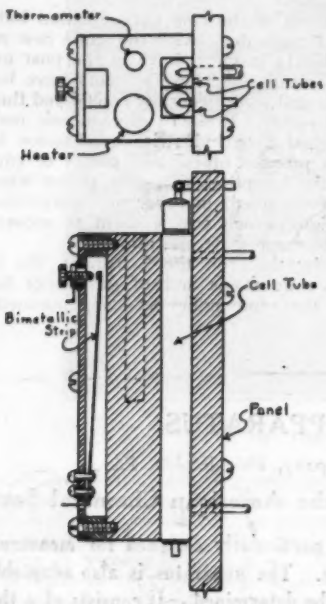


Fig. 3.—Thermostatic Block.

Fig. 4 shows the completed apparatus, while fig. 5 gives the circuit diagram. The large cylindrical hood carries the slide wire contact, and also a scale of 1000 divisions, each of 0·216 in. (0.55 cm.). The cell, in its thermostatic block, is mounted on the upright panel at the rear of the instrument. The panel also carries a milliammeter and rheostat for adjusting the bridge current to the desired value. A small pilot lamp, observed through a hole in the panel, is in series with the thermostat, and by its switching on and off calls attention to the proper operation of the thermostat. The temperature at which the thermostat controls may be set by the knurled screw on the front of the block. Ordinarily the temperature is maintained 5° or 10° C. above room temperature.

The resistance *E*, normally 0·1 to 0·3 ohm, is a so-called current compensating coil (*2*), and is intended to make the two wires electrically identical for all temperatures. It is determined by experiment, and may be connected in series with either cell wire. By the use of this compensating resistance the bridge current may be varied over a wide range (150 to 300 milliamperes) without changing the balance point of the slide wire *K*, if dry air is contained in both cell tubes. It is, of course, possible to dispense with this compensating coil, but its use simplifies the operation of the instrument.

Inasmuch as industrial gases differ greatly in thermal conductivity, a set of shunts, *c*, *d*, and *e* is provided for the slide wire *K*. By setting the proper shunt on the slide wire with a movable plug, the range of the instrument can be varied over wide limits. Further variation is possible by changing the bridge current within the limits of 150 and 300 milliamperes. The lower the value of the shunt resistance and the higher the bridge current, the higher the sensitivity will be.

Any galvanometer may be used which will be properly damped on the circuit. The one usually employed is a box-type reflecting instrument with a sensitivity of 25 micro-volts per 1 mm. scale division, and an external critical damping resistance of 80 ohms. Naturally, if higher sensitivities are required a more sensitive galvanometer should be chosen.

Measurement of Air-Gas Ratios.

This instrument was first designed to determine the percentage of illuminating gas in air, for experimental work on gas heating devices. A sample of the unburned gas-air mixture is withdrawn from the burner just after the mixing device, and is passed into the cell *X*, through a calcium chloride drying tower. When sufficient gas mixture has been passed through to sweep out the tubes, the flow is stopped and the bridge is balanced. This gives the reading K_x on the slide wire. Then dry air is passed through the cell tube and a reading K_a is obtained. Finally, pure fuel gas (illuminating gas in this case) is passed through, and the reading K_1 is obtained.

Fig. 6 shows a curve (1) of fuel gas concentration, in air, *versus* slide wire readings *K*. The curve is a calibration curve for the apparatus, and has been previously determined by passing known mixtures of fuel gas and air through the cell tube *X* and taking the slide wire readings. The value at 100 p.ct. fuel gas is the important point. Such curves ordinarily will be straight lines, or, if not straight, the curvature will be slight.

Now, having the slide wire reading K_x for the unknown mixture, reference to the curve (1) will give the percentage of fuel gas in the air directly, or if desired the air-gas ratio.

Several such calibration curves are taken for different fuel gases, as shown by curves (2), (3), (4), and (5). Then if it is desired to determine the percentage of any fuel gas in air, the proper curve is selected by the determination of K_1 for pure fuel gas, as above. Then K_x is determined for the unknown mixture, and by reference to the proper curve the unknown air-gas ratio, or percentage of fuel gas, is at once found. For any one general type of fuel gas, a family of curves can be drawn by taking only a few measurements with known gas-air mixtures. Thus this family of curves can be used as above, the exact values of the unknown air-gas ratio being determined by graphical interpolations between two adjacent curves if necessary.

Precision of Apparatus.

No definite statement can be made of the accuracy of the apparatus, since the composition of the gases analyzed varies over wide limits, and all errors vary with the gas composition. However, the accuracy is of the order of ± 0·2 p.ct. of gas, on the gas-air scale. The precision, of course, varies with the type of galvanometer used, as well as with bridge current and slide-wire shunt employed. In general the precision is ±0·1 p.ct. of gas, on the gas-air scale.

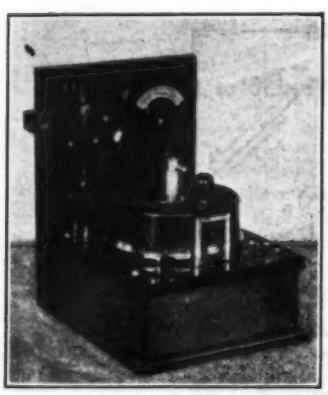


Fig. 4.—Complete Air-Gas Ratio Apparatus.

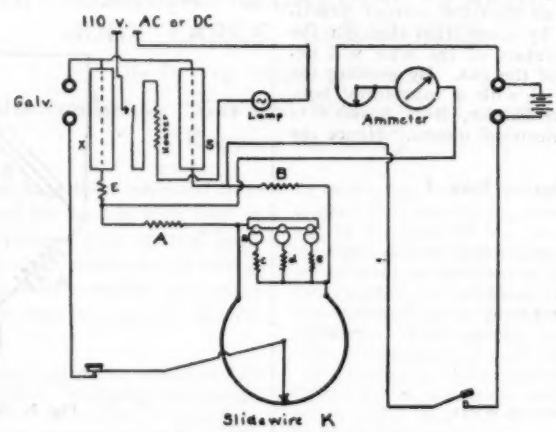


Fig. 5.—Circuit Diagram.

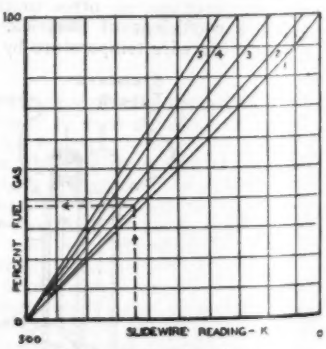


Fig. 6.—Calibration Curves.

Other Uses for Apparatus.

The apparatus is not confined to measurements of fuel-air ratios, but can be adapted for many laboratory and industrial applications in which a compact apparatus is desired. It can be calibrated for a wide variety of gaseous mixtures and used in numerous research problems and in tests of various equipments. It has all the advantages of the thermal conductivity apparatus—speed of operation, freedom from absorbing chemicals, high accuracy, and instant adaptability to various problems of analysis.

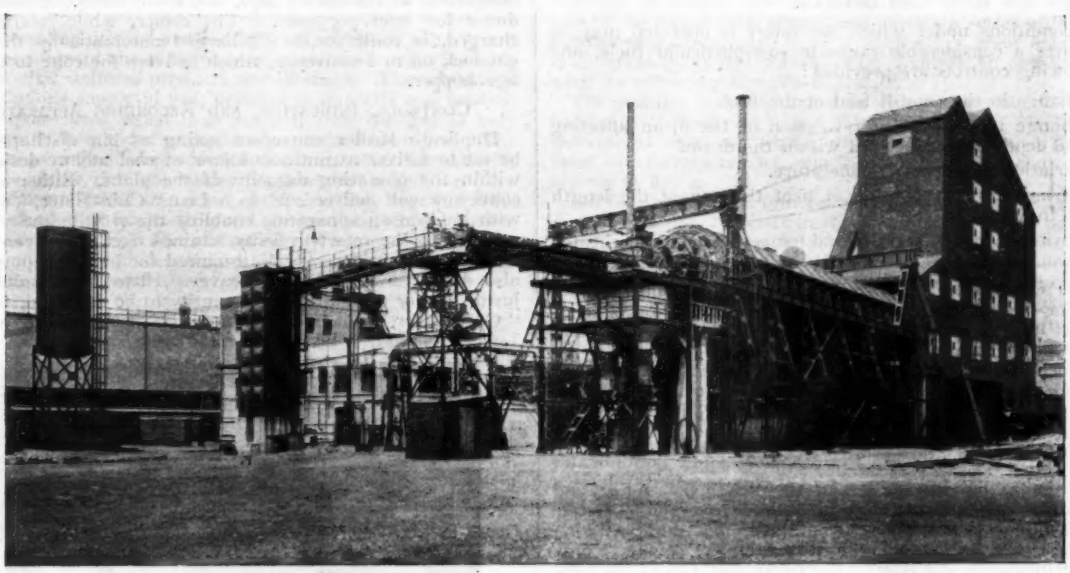
Literature Cited.

[1] Palmer and Weaver, Bur. Standards, Tech. Paper **249** (1924).
[2] Peters, U.S. Patent 1,504,707 (1924).

LOW-TEMPERATURE CARBONIZATION IN THE GAS INDUSTRY.

Description of Four Plants Installed in London Gas-Works.

On Sept. 25, the Institute of Fuel visited the low-temperature carbonization plants installed at the Greenwich Works of the South Metropolitan Gas Company and at the Fulham and Richmond Works of the Gas Light and Coke Company. The following descriptions are taken from brochures prepared for the occasion. After the inspection, there was a discussion on the subject.



GENERAL VIEW OF "K.S.G." PLANT.

"K.S.G." PROCESS AT GREENWICH.

By S. McEwen, A.R.S.M.

This plant has been installed by Coal Oil Extraction, Ltd., at the Greenwich Works of the South Metropolitan Gas Company. The "K.S.G." process was developed under the direction of the late Hugo Stinnes, who drew on the extensive resources of his huge organization for the services of skilled engineers, research chemists, and operators experienced in the processing of fuel. A commercial unit was constructed and put into operation in 1924. For periods over many months the retort was commercially operated, and from time to time such modifications and improvements were made as were found to be desirable for better economic operation; during the last two years it has been operated continuously with economically satisfactory results.

The process has been developed for the carbonization of finely divided coking bituminous coal in order to secure the maximum quantity of liquid bye-products and to produce a solid semi-coke sufficiently hard and dense to meet the demands of the domestic fuel market. The process consists in preheating the coal to such a degree that when subsequently heated to a point where it assumes a plastic condition it can be rolled up into masses of the desired size, and carbonization completed at low temperatures.

Heating is effected both externally by means of products of combustion and internally by means of superheated steam; and the proper control of these sources of heat, together with the preheating of the coal, influences the size and density of the coke masses produced.

The process is one which permits of continuous and uniform operation, coal being fed in continuously to the inner or preheating drum, while semi-coke is discharged regularly from the outer or carbonizing drum. This method of operation ensures uniform products. The production of gas can be maintained over a period of 24 hours with but slight variation in quality or quantity. The method of treatment is such that the bulk of the gas is evolved while the coke remains plastic, and the subsequent rolling of the charge during its passage through the retort results in the production of more or less spherical coke masses which are dense and which are uniformly carbonized throughout.

Description of Retort.

The retort consists essentially of an inner drum and an outer drum, the former being concentric with the latter. The outer drum has a diameter of 10 ft., and is 72 ft. in length. The inner drum has a diameter of 5 ft. 8 in., and is somewhat longer than the outer drum. The assembled retort is arranged to revolve at the rate of one revolution in 90 seconds, and it is an important feature of the design that the inner drum, which under operation is comparatively cool and therefore maintains its strength unaffected by heat, carries the weight of the whole retort. All supports and power transmission parts are applied to the inner drum; the outer drum being attached to it with provision for relative expansion. The assembled retort, as erected, is inclined 3° to the horizontal.

The whole retort is built in a steel clad brickwork setting, so designed that the external heat to be applied may be controlled and distributed over the external surface of the drum as required.

The coal, which is fed from a hopper through a screw conveyor to the inner drum, is made to travel throughout the length of the drum to the upper end by means of a spiral. At the upper end there are ports or openings through which the coal may flow from the inner drum to the outer drum. The rotation of the inclined retort allows the coal which is being carbonized to travel gradually throughout the length of the outer drum from its upper end to the lower end. At the lower end of the retort provision is made, in the form of suitable ploughs and chutes, to discharge the coke from the outer drum into the lower drum head, and thence to the receiving hopper for the semi-coke.

Steam tuyeres are equally distributed around the interior surface of the drum, but a rotary valve provides for the admission of steam only to those tuyeres which, during the revolution of the drum, are buried in coal.

The greatest possible skill has been exercised in the design and in the selection of materials for construction to ensure continuity of operation and the reduction of maintenance cost to a minimum.

Heating System.

The carbonization of the coal is effected by a combination of internal and external heating; the latter being by products of combustion, while the internal heating is by the admission of steam superheated to approximately 500° C. The superheater is built within the brickwork setting of the retort, and the steam supplied to the superheater is taken from the exhaust of a steam turbine which drives the fans. Thus the steam employed has already done useful work and is at a low pressure when passed through the superheater. The external heating of the retort embodies a very important provision, in that arrangements are made for the re-circulation of part of the flue gases to mix with the products from the combustion chamber. Thus, producer gas being used as a source of supply of heat, the temperature within the combustion chamber is approximately 1300° C. The products of combustion at this temperature are then mixed with flue gases returned from the outlet of the setting, which are at a temperature of 325° C., and in such a proportion that the final temperature of the mixture may be fixed within a range of 600° to 700° C., as may be found necessary for the particular coal under treatment. There

are many advantages from the adoption of this system of heating, which may be enumerated as follows:

(*a*) The temperature of the products of combustion is reduced from 1300° to 650° C. by the admixture of an inert gas, instead of by the admixture of excess air, which latter is the customary alternative. Consequently the circulating gases are free from excess oxygen and the durability of the retort is thereby ensured.

(*b*) There is a saving of approximately 50 p.ct. of the loss of heat to the chimney by using flue gas as a diluent instead of excess air.

Controls.

The conditions under which the retort is operated may be varied over a considerable range to suit particular fuels, and the following controls are provided:

(*a*) Change in the rate of feed of the fuel.

(*b*) Change in the rate of revolution of the drum affecting the depth of the fuel bed within the drum.

(*c*) Variation in average temperature.

(*d*) Variation in distribution of heat throughout the length of the drum.

(*e*) Variation in the quantity and temperature of superheated steam used.

While pyrometers are installed at various points in the setting for the purpose of determining the distribution of heat, the retort itself is utilized as an indicator of working temperatures in both the inner and the outer drums. The retort being firmly anchored at one end, the longitudinal expansion of the inner and outer cylinders is shown on an indicator. This expansion from cold to working temperature is 5½ in. in the case of the outer drum and 3½ in. in the case of the inner drum.

Complete Installation.

In designing the installation of the "K.S.G." retort and the accessory equipment, it was desired that the complete plant should be practically self-contained, and that provision should be made for obtaining a very complete set of records of the performance, not only of the retort, but also of the various accessories.

For heating the retort a steam-jacketed gas producer has been installed which generates sufficient steam required in the manufacture of gas. The producer gas is utilized for heating the retort, and the waste gases from the retort pass through a waste-heat boiler. The latter generates sufficient steam to provide the power for operating the retort, circulating and pressure fans, and exhausters. The exhaust steam from these auxiliary engines is superheated within the setting of the retort and provides the necessary superheated steam required to secure partial carbonization by internal heating. The capacity of the gas producer is such that, in addition to supplying the necessary amount for heating the retort, a supply is available for operating a gas engine directly coupled to an alternator. The electric current so generated provides power for the motors for the coal and coke handling equipment, various pumps, and other units, together with a certain amount of electric lighting.

It will be possible to determine over long periods of operation the power utilized for operating in terms of fuel consumed.

An attempt has been made to instal indicators and recorders wherever practicable, so that the performance of every individual unit may be carefully tested and a very complete thermal balance be written covering the whole sequence of operations.

Coal from the delivery wagon is conveyed to a crusher, so that coal as ultimately delivered to the receiving hopper has the following screening analysis:

		P.Ct.
Over	⅜ in. mesh	0·5
Through	⅜ ,, ,,	99·5
,,	¼ ,, ,,	98·1
,,	⅛ ,, ,,	86·8
,,	30 ,,	44·6
,,	60 ,,	19·2
,,	100 ,,	12·0

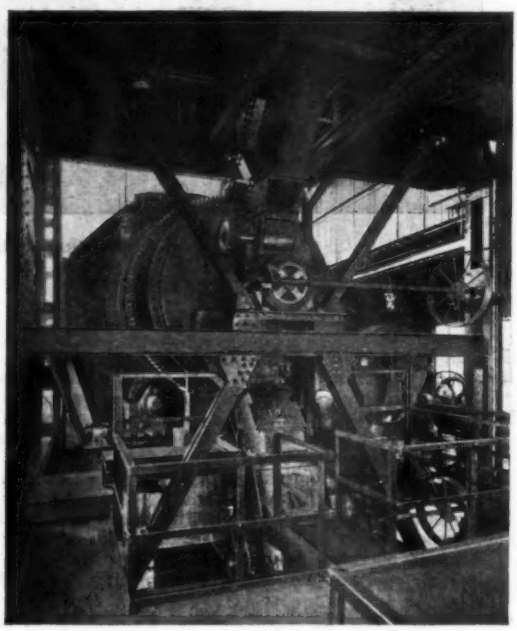
From the receiving hopper the coal is delivered by a bin discharger to a measuring device which records the amount of coal delivered to the retort. From the meter, coal flows to the feed screw of the retort, and at this point provision is made for such blending as may be found to be desirable. Semi-coke dust which is to be blended with the coal is delivered by conveyor to a meter, with the result that the two streams—that is, of coal and of semi-coke dust in the predetermined proportions—enter the feed screw of the retort. The passage of the mixed charge through the inner drum ensures perfect blending of the finely divided coal and semi-coke prior to carbonization.

While the coke is discharged continuously from the retort, the subsequent handling for a time becomes intermittent. The discharged coke is allowed to accumulate in a hopper which is provided with interlocked valves so that the communication with the retort is closed while the contents of the hopper are discharged into a skip hoist. At about half-hourly intervals the hot coke is elevated by the skip hoist and is discharged into a receiving hopper. The latter has a cover which is automatically opened and closed by the movement of the skip. The hot coke from the hopper now passes over a screening device, and all coke above ½ in. in size is delivered to a cooler, while the fines separated by the screen pass to a second screen, the dust below ¼ in. in size being conveyed back to the retort for blending purposes. The semi-coke of the size between ¼ in. and ½ in. is delivered to a hopper where it is available as fuel for the gas producer.

Cooling of the coke is secured by the circulation of inert gas, this being preferable to water quenching, as there is less disintegration of the coke lumps, and more attractive fuel is produced for sales purposes. The cooler, while intermittently charged, is continuously discharged automatically through a gas lock on to a conveyor, which delivers the coke to the storage hopper.

Controls, Indicating, and Recording Apparatus.

Duplicate Redler conveyors acting as bin dischargers can be set to deliver a continuous flow of coal at any desired rate within the operating capacity of the plant. Either of these conveyors will deliver coal to a Lea "Cubi-Meter," complete with integrating apparatus, enabling the total quantity of coal supplied to the retort to be ascertained over any given period. The finely divided semi-coke required for blending purposes is also delivered by a Redler conveyor, fitted with suitable adjustments for regulating the quantity to be delivered, to a Lea "Cubi-Meter," so that the quantity of semi-coke used for



Feed and Discharge End of Retort.

blending over any given period can be recorded. It being desired to maintain a balance of pressure within the "K.S.G." retort, an "Arca" regulator has been installed in the gas offtake main. The exhauster is also fitted with an automatic regulator, so that the desired differential between the suction at the inlet of the exhauster and the retort side of the "Arca" regulator is automatically maintained.

The scrubbed gas leaving the light oil plant passes through a "Connersville" meter fitted with an integrator, an indicator, and a recorder.

A sampling pipe from the discharge of the "Connersville" meter leads a portion of the gas to the instrument room, where it is delivered to a continuously recording calorimeter, to a gravitometer, and other testing apparatus.

Measurement of the quantity of producer gas made and utilized can also be made by means of a recording "Integra" gas meter coupled to a manifold, so that records can be taken of:

(*a*) Total producer gas made.

(*b*) Gas supplied to the combustion chamber of the retort.

(*c*) Gas supplied to the gas engine driving the generator.

A CO_2 recorder gives a continuous record of the performance of the producer.

Pyrometers are installed at various points throughout the setting of the retort; other pyrometers indicate temperatures of gases before and after the superheater, before and after the waste-heat boiler, and in the main delivering superheated steam to the retort. These various pyrometers are coupled to an indicator in the instrument room, where the complete range

of temperatures throughout the system can be noted and recorded.

A CO_2 recorder, also in the instrument room, continuously samples the products of combustion utilized for heating the retort. Every provision is being made to secure very high efficiency of combustion with a minimum of free oxygen in the heating gases.

Characteristics of "K.S.G." Process.

The main characteristics of the "K.S.G." process may be summarized as follows:

The best results are secured when the coal to be carbonized is in a finely divided condition. Thus all small coal, including the finest dust, is available for treatment provided it has the necessary coking quality and is free from excess of ash.

The operation of the retort is continuous and uniform, with the result that uniform products are obtained. The advantage of a continuous supply of gas, uniform in quantity and quality, will be appreciated when it is realized that the gas is very rich and must be blended to produce a standard town gas. The production of a blended product of constant value is practically impossible if the rich gas varies considerably in quality.

The construction of the retort, of its setting, together with the method adopted for heating and the continuity of operation, permits of a very high thermal efficiency being obtained.

The semi-coke produced from a highly swelling bituminous coal is dense, hard, and highly reactive.

Operating Results.

Arrangements have been made to obtain a complete record of technical and commercial performance. Observations will be taken continuously over a period of many months, and therefore operating results will not be available for some time. At the time these notes are being written the plant has only been in operation for a comparatively short period, and therefore commercial results at this stage can only be the subject of intelligent anticipation. The continued operation of the plant, however, will unquestionably contribute much valuable information as to the economic possibilities of low-temperature carbonization.

"SALERMO" PROCESS.

A plant on this principle has been installed by Messrs. Salermo, Ltd., at the Fulham Works of the Gas Light and Coke Company.

The "Salermo" process has for its main object the distillation of coal to produce industrial fuels—solid, liquid, and gaseous. The fuels produced have physical and chemical properties which differentiate them from the fuels hitherto obtainable, giving them a premium value for many technical operations, some of which are old, while others result from the availability of these new materials.

The "Salermo" process produces a solid fuel, retaining sufficient volatile material to secure its ready ignition, and produces at the same time a high percentage of oil, "primary tar," and gas of high calorific value.

The basic principle of the process, derived from a prolonged study of the thermal and chemical properties and reactions of coal, consists in the external and progressive heating of small particles kept in continuous movement, to secure repeated brief contacts of the particles with a heated surface. The process is continuous, and the drying and pre-heating of the coal by means of waste furnace gases is an integral part of it.

The retort to be described, working on the above principle, is the result of several years' study and experimenting on the part of Mr. E. M. Salerni, who is closely associated with the Salermo Company. The retort has been thoroughly tried out under industrial conditions, not only on coal, but on other carbonaceous materials, such as lignite and oil shale.

It was decided in 1926 to erect an experimental and demonstration retort in this country, and, through the courtesy of the Gas Light and Coke Company, the Fulham unit, to deal with 24 tons per day, was installed; the first run being made in September, 1927. From that date there has been put through a series of searching tests to establish, with a view to standardization, points of design, grouping of components and auxiliaries, materials to be used, and generally to perfect an operating technique for maximum yields and efficiencies.

The materials treated have ranged from oil shales, through a variety of non-coking coals, to the most strongly coking Durham coals. The latter are notoriously difficult to treat at low temperatures, even in static systems, but the "Salermo" process is able to carbonize them in a regular and continuous manner. The products have been quantitatively estimated and examined in detail, and the balance-sheets which figure later are based, as far as British coals are concerned, on the runs in this retort.

The basic principle upon which the working of the retort depends is best seen by reference to figs. 1 and 2.

A number of semi-circular troughs A, which may vary in diameter from 12 in. to 16 in. for different retorts, are joined together in series. An octagonal steel shaft lies along the axis of the top of each trough and carries a series of **T** headed paddles or stirrers, fixed close to each other, their heads being in different diametral planes. Fig. 2 shows an end trough A, with its adjoining troughs B and C.

The paddles may be turned in either direction, referred to herein as "clockwise" and "anti-clockwise." It has been determined that, for coal, turning anti-clockwise gives the most satisfactory results, and this is the motion shown by the arrows in fig. 2.

On feeding the coal uniformly along the length of the trough A, and rotating the shaft in the direction shown by the arrow, the coal will flow over into trough B, taking up the contour shown by the dotted line, the maximum height of which is at the end of the paddle when in the vertical position. Similarly, the rotation of the shaft B will cause the coal to flow into trough C, but this flowing motion is only continued while the material is being fed into trough A. The cessation of feed automatically causes cessation of flow, for the rate of feed is the rate of flow.

The coal in the troughs has two major motions; the first, a distributing circular motion within the trough, the other a flowing one from trough to trough. In addition, there is a third motion which is of interest. At the points E, E in fig. 2, a small cylinder of coal is formed, turning in the reverse direction to the paddles.

From the foregoing it will be seen that this arrangement of troughs, shafts, and paddles constitutes a method of causing coal to travel in a positive direction, while at the same time it is being agitated within its mass; the rate of travel in the positive direction being governed by the rate of feed. The "Salermo" retort is constructed around this principle.

The plant will deal with 24 tons of non-coking coal, or 12

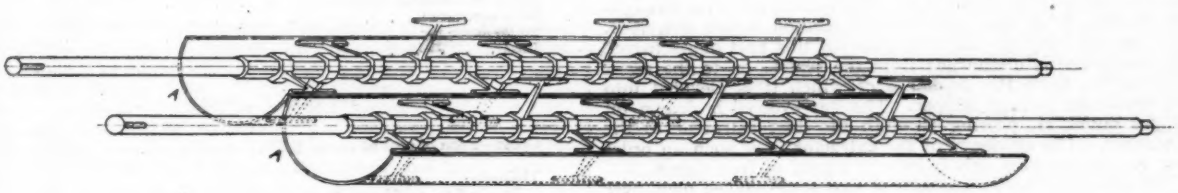


FIG. 1.

tons of coking coal, per 24 hours, and consists of three main portions:

(*a*) Carbonizing chamber.
(*b*) Drier.
(*c*) Furnace.

The carbonizing chamber consists of 14 troughs forming the floor, the two end ones of which form the inlet and outlet seals. They are semi-circular, 12 in. diameter and 6 ft. long, and are made of silicon manganese steel $\frac{1}{8}$ in. thick. The sides and roof of the chamber are of steel, the plates being

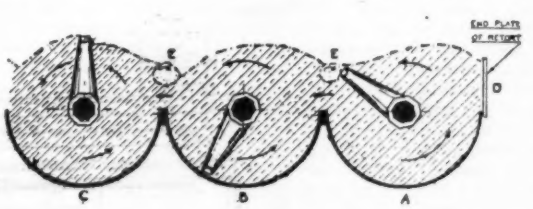


Fig. 2.

connected together by an articulated joint, which provides for freedom of expansion and gas-tightness. The shafts are of hexagonal steel with the ends turned to form journals, and each shaft carries 12 paddles, those nearest the sides of the retort being **L** shaped, while the remainder are **T** shaped.

The trough at the feed end of the retort is of a special design, providing a seal against the pressure of gas. A view of this trough, together with its connections, is shown in fig. 3.

It will be seen that the trough is divided by vertical steel

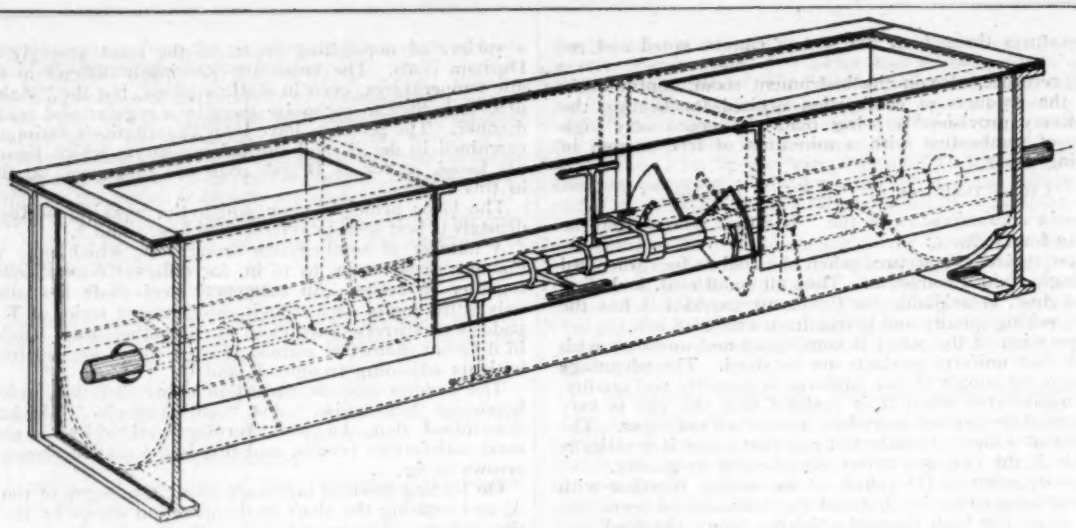


FIG. 3.

plates into three compartments, into the two end ones of which the coal is delivered from above. The only means of communication between the end portions and the centre is by passing under the two division plates.

The drier, as will be seen from a reference to the longitudinal section of the plant (fig. 4), is of the simplest construction, consisting of two horizontal floors formed by the top casing of the horizontal flues, through which the exhaust furnace gases pass. These gases heat the coal which is being conveyed along the length of the floors by a chain drag of special construction.

The furnace is designed for the burning of solid fuel, the hot gases taking the path indicated by the arrows.

In the carbonizing process, the coal, crushed to a maximum of ⅜ in., is discharged from the hopper by means of a turntable, passing over a magnetic separator into trough A, which spreads the coal across the width of the drier platform, where it is caught by the scraper bars of the chain conveyor, and conveyed along drier platform B, falling at the end on to drier platform C, conveyed along this platform to point D, where it falls into the feed chute E, hence by way of the seal trough F into the carbonizing chamber, it being caused to travel throughout the length of the retort by the method before described. The carbonization of coal occurs during this part of its travel. The semi-coke is discharged from the seal G on to the semi-coke cooler, from the discharge of which it is elevated into the semi-coke storage hopper. The gas evolved is drawn off by gas outlet H, passing through the dust extractor to the condenser. The efficiency of the extractor is of such an order that the tar contains only from 1 to 2 p.ct. of free carbon.

The semi-coke cooler consists of two water-cooled pads over which the semi-coke is carried by a chain conveyor, in a manner similar to that employed for the drying of coal.

The following balance sheets are representative of the normal working of this " Salermo " unit, and were obtained as the result of an industrial scale run :

Coal Used—Durham (Wearmouth), a Strongly Coking Coal.

		P.Ct.
Proximate analysis—		
Moisture		1·8
Volatile matter		30·2
Ash		5·7
Fixed carbon		62·3
Calorific value—		
Gross	14,040 B.Th.U. per lb.	
Net	13,530 " "	

Percentages of Products by Weight.

Semi-coke (containing 9·9 p.c.t. volatiles), 14·66 cwt. per ton		73·3
Calorific value—		
Gross	13,590 B.Th.U. per lb.	
Net	13,330 " "	
Dry tar, specific gravity 1·050, 21 gallons per ton		9·8
Calorific value—		
Gross	16,990 B.Th.U. per lb.	
Net	16,370 " "	
Gas, specific gravity 0·643 (air = 1), 3075 c.ft. per ton		6·8
Calorific value—		
Gross	936·4 B.Th.U. per c.ft.	
Net (calculated)	850 " "	
Liquor		6·5
Moisture, extracted in drier		1·8
Dust recovered		0·7
Solids from tar		0·3
Loss		0·8
		100·0

Thermal Balance.

	Therms.
Gross—1 ton of coal at 14,040 B.Th.U. per lb. =	314·5
Yielded—	
Semi-coke—14·66 cwt. at 13,590 B.Th.U. per lb. =	223·1
Tar—220·5 lbs. at 16,990 B.Th.U. per lb. =	37·5
Gas—3075 c.ft. at 936·4 B.Th.U. per c.ft. =	30·5
Solids—22·0 lbs. at 16,000 B.Th.U. per lb. =	3·5
Loss = 6·3 p.ct. =	19·9
	314·5

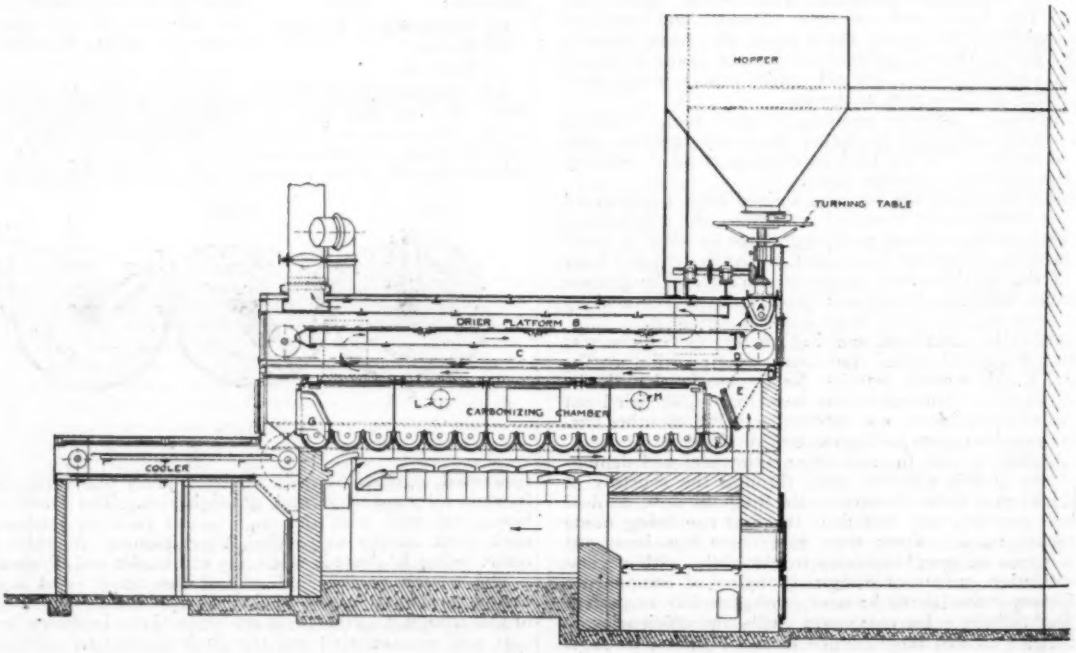


FIG. 4.

In considering the Fulham unit, it must be borne in mind that it was one of the first "Salermo" units erected, and when information from working practice was unavailable. The results obtained since, from this and other bigger units, have furnished experience and data which, while proving that the underlying principles are true, have given rise to a design which renders the Fulham plant obsolete. In the latest plant at present under construction, the following improvements have been incorporated.

I.—The furnace is an adaptation of the most modern type of gas furnace. Individual burners for each trough are provided so as to give absolute control of the temperature to which it may be desired to raise any portion of the retort.

The metal of the troughs is shielded from the furnace gases by refractory materials having a high coefficient of heat conductivity. This shielding eliminates any tendency which the metal may have towards oxidation.

A special system of recuperation ensures high thermal efficiency in the burning of the gas.

II.—The troughs are made from a special alloy steel which allows of greater working temperatures than are possible at Fulham.

III.—The carbonizing chamber and the drier are practically two separate units, giving greater ease of access to the carbonizing chamber, and also minimizing the possibility of unobserved gas leaks.

IV.—A turntable type of seal has been adopted for the semi-coke exit.

V.—Dust removal is carried out in a type of extractor based on a novel use of baffle plates.

VI.—The flue gases are brought into actual contact with the coal prior to their exit, increased thermal efficiency being thus obtained.

VII.—The coal feeding arrangements are designed in order to effect an even distribution of feed coal across the width of the drier platform, while allowing of easy control of the amount fed.

VIII.—The coal storage feed hopper has been discarded, and arrangements have been made for the continuous supply of coal to the retort, the amount fed being checked by weighing through an Avery automatic weigher.

IX.—Modifications and improvements have been made to the mechanical equipment, while the structure in general has been strengthened.

X.—A tubular form of semi-coke cooler has been adopted.

Materials Treated and Products Obtained.

The "Salermo" process does not produce directly lump fuel of the type required for domestic use. In consequence, it is not limited in its operations to the particular range of coals yielding dense hard lumpy coke. It can deal with any kind of carbonaceous material which on heating yields a solid residue, gas, and condensable vapours.

Flexibility is secured by having a number of variables in the plant, each of which is under independent and easy control. Once the optimum conditions have been established for any given material, the only variable which requires alteration is the rate of feed, which depends on the temperatures employed and the particular kind of product aimed at.

"Salermo" semi-coke is small, and its applications in the industrial field are, as boiler fuel, for rotary cement kilns, and for blending with coal, to give improved coke.

The mechanism of the "Salermo" retort is characterized by the low power required for its operation. Omitting the amount used for the elevation of the coal to the retort feed hopper, the whole of the load from the retort mechanism varies from 1·5 KW.-H. on non-coking coals, to 7 KW.-H. for strongly coking coal, for an input of 1 ton per hour.

FUEL RESEARCH BOARD PLANT.

This installation of the Fuel Research Board's plant is at the Richmond Works of the Gas Light and Coke Company.

At the Fuel Research Station it had always been considered that any process to be commercially successful must be reduced to the extreme of simplicity, and this had been aimed at in the design of the Fuel Research Station low temperature retorts, which are simple cast-iron erections inside a simple brickwork setting.

The experience obtained at the Fuel Research Station was thoroughly discussed between the representatives of the Gas Light and Coke Company, the Fuel Research Station, and the Woodall-Duckham Company, with whom the Gas Company had decided to place the contract for the erection of the retorts. As a result of this, certain modifications in design were adopted, but, in general, the retort and the method of heating were put in as suggested by the Fuel Research Station. The general arrangement of two of these retorts and a section of one of the heating walls is shown on the drawing on next page. The retorts themselves are each in four sections, 21 ft. high over-all, and internal dimensions of 6 ft. 6 in. by 7 in. at the top, with a steady tapering of 1 in. per section until 2 ft. 7⅛ in. from the bottom, where the width is 11 in. The taper on the width then increases, so that the retort is 1 ft. 1 in. wide and 6 ft. 10 in. long at the bottom. This shape was adopted because experience had shown that the whole of the retort tended to bulge, but that the base was less likely to open out than the remainder, and in one of the settings at the Fuel Research Station this had resulted in a constriction at the base of the retort. It was hoped that this difficulty would be avoided by opening out the base in the manner described. The retorts are built in four sections, each section consisting of two side plates and two end plates, and the joints are bolted together.

In order that as much information as possible might be obtained, the retorts were not all made of the same material, but as follows:

(*a*) 18 of a low silicon iron, according to specification and cross-section details approved by the Cast Iron Research Association.

(*b*) 12 of cold-blast iron to a different design and cross-section.

(*c*) 6 of the low silicon iron suggested by the Cast Iron Research Association from the same patterns as (*b*).

(*d*) 4 of "Perlit" iron from the same patterns as (*b*).

The retorts all rest upon brickwork bases which, in turn, rest on cast-iron coke chambers, into which the coke is discharged by an extracting gear, which is a modification of the usual Woodall-Duckham type. A door of a novel and interesting design by the Woodall-Duckham Company is fitted to each coke chamber. The coal is charged into the retort through a circular valve, which is raised about 12 in. above the casting covering the retort. There is a gas offtake at each end of this casting, and provision is made for rodding through the offtake pipes and through one position on each side of the coal valve. The gas discharges from each pair of retorts into a short dry main, in which sprays of liquor are used to precipitate the dust. Each pair of retorts can be shut off by a sealed valve from the common collecting main.

The original system of heating the low-temperature vertical retorts at the Fuel Research Station had been quite efficient and had given very close control over the retorts, but it involved a very large number of control cocks and adjustments. An alternative system of heating, therefore, has been devised and experimented with which, while giving full effect to the radiant heat from the brickwork on to the retort, obviates as far as possible the flames impinging upon the retort. The control cocks have also been reduced to a minimum.

In this method of heating, the open vertical burners were replaced by hollow walls which separated each retort from its neighbour. The walls were constructed with zig-zag flues, and provided with a single burner at the base through which the whole of the heating gas was supplied. A portion only of the air required for combustion was supplied through this burner, and further air was supplied at several higher levels at points where the gases change their direction at the ends of the zig-zag passages. At the top of the hollow wall the burnt gases passed out through a series of ports and downwards in the space between the hot wall and the retort, and were led away to the chimney by means of a bottom flue.

The experimental wall and retorts which were built to try out this system of heating were built to full scale and represented two-thirds of two retorts with the heating wall between them. Water tanks, with varying thicknesses of insulating material between them and the hot side of the retort, represented the action of the coal in absorbing heat from the wall and flue gases.

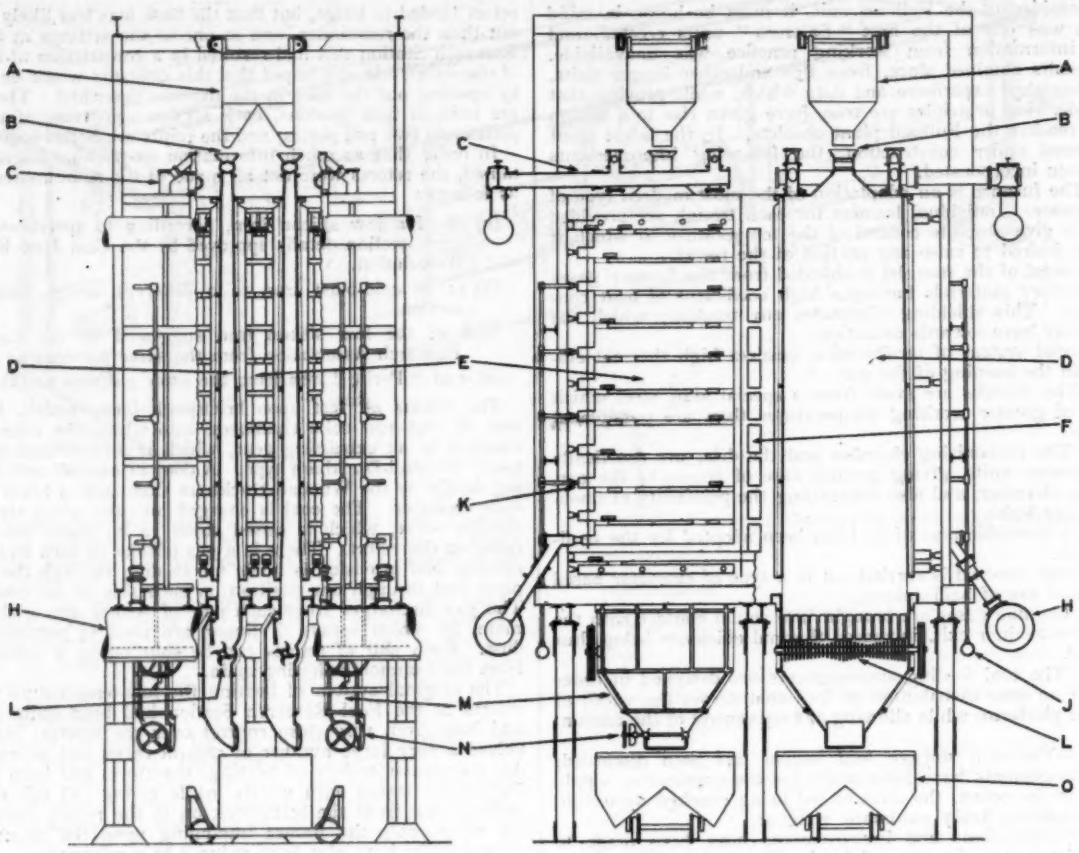
The experiments, which included heating with cold coal gas, cold water gas, cold producer gas, and hot producer gas, were successful, and a setting of two retorts at the Fuel Research Station was heated in this manner for some time before the Richmond plant was erected.

The Woodall-Duckham Company suggested a type of burner which would fit in with the arrangements they proposed for Richmond, and experiments were carried out on the experimental wall with a burner of this general design until the necessary dimensions were found for the non-luminous combustion of any of the gases mentioned. This method of heating with certain modifications was in due course used for the retorts at Richmond, and this type of burner was also fitted.

The system of heating consists in the use of common hollow walls on each side of each retort. In each hollow wall horizontal flues form a passage for gas from the bottom to the top of the wall. Exits are provided for the gas on each side of the hollow wall at the top, so that the gases then pass down between the wall and the retort and away through the base of the wall. The heating gas is supplied near the base of the hollow wall with a certain proportion of the air necessary for combustion. Further supplies of air enter the wall at different positions, in such a way that the heat given to the retort by radiation from the brickwork and convection from the hot gases is in accordance with that required for the carbonization of the coal in the continuous working of the retort.

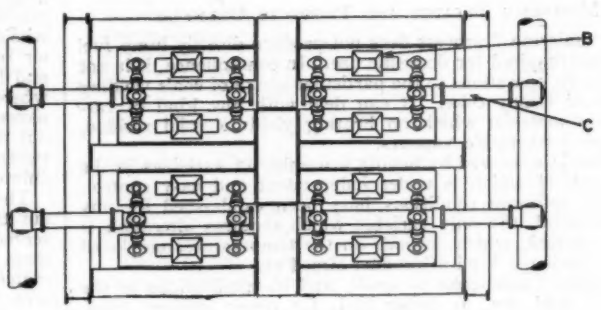
As a precautionary measure, steel baffle plates are placed round the retorts immediately opposite the orifices, out of which the gases issue from the hot wall, so that if by any chance flame does issue from these orifices, it will be diverted from actually striking the retort itself.

The modification in the arrangement of the flues consisted in increasing the number of ports in each horizontal flue through which the heating gas could pass. In the Research



KEY.

A—Coal Charging Car.
B—Coal Valve.
C—Gas Offtake.
D—Cast-Iron Retort.
E—Combustion Chambers.
F—Waste Gas Flues.
H—Producer Gas Main.
J—Secondary Air Main.
K—Secondary Air Inlets.
L—Coke Extractor.
M—Coke Hopper.
N—Coke Discharge Door.
O—Coke Car.



Station setting there is only one port. Three such ports were, however, put in, one of which could be covered by a damper. Experience has shown that the extra openings were unnecessary and, in fact, might be omitted with advantage.

The last chamber in the hollow wall is divided longitudinally, and the ports leading into these two passages can be regulated by dampers. In this way it is possible to divert any portion of the flue gas from the retort on either side of the wall. The flue gases issue from these two passages through orifices; they then find their way down to the base of the retort and pass away through similar passages to the common flue. The connection to the common flue can be closed by a damper. The common flue consists of a chamber which runs the whole length and height of the bed and is situated between the two halves of the setting, which are placed back to back. There is a certain quantity of supporting brickwork in the flue chamber to take the strain of the tie rods which hold the two sides of the setting together. The bench, it must be remembered, consists of 40 retorts placed in two rows of 20.

The above arrangement, while being compact, makes a very wide bench, and it was soon found that inadequate provision had been made for coping with the heat radiated from the top covering plates of the retorts themselves and from surrounding brickwork, not to mention that from the offtake pipes and collecting mains. The system in use at the Fuel Research Station was then installed with some measure of success, but it is evident, with so wide a bench, the more open the covering structure can be, particularly at the sides, the more comfortable will be the working of the retorts.

The heating gas is provided by four externally-built producers of the standard stepped-grate type. Each can be shut off as necessary, and they supply the gas through two steel mains lined with firebrick, 2 ft. 6 in. internal diameter. The gases are supplied to the hot wall through a 6-in. butterfly valve which governs the burners.

For simplicity in controlling the gas supply, it has been found better to keep a pressure in the fuel-gas main, and the flow of gas has been regulated by the somewhat novel device of keeping a constant difference between the pressure in the fuel-gas main and that at the base of the chimney. In this manner the effect of variations in atmospheric conditions, which, on first lighting up, affected the settings considerably, is nullified.

The air for combustion is supplied by motor-driven fans, and is distributed through two 12-in. air trunks which run parallel to the fuel-gas mains. To these are connected distributing pipes for each wall. Each distributing pipe is governed by a cock at the bottom, and at each position in the wall where air is admitted the supply is governed by an orifice diaphragm of a certain size. It is thus possible, by regulating the cock at the base of the air supply and the valve on the gas supply, to reduce the total quantity of gas burning on one wall while keeping the proportional distribution of heat the same.

None of the manufacturers of the iron used was able to guarantee that their material would stand a temperature of more than 625° C. On the other hand, if the temperature is reduced much below this, the throughput of the retorts must be reduced, and certain coals have been found difficult to work. It is therefore essential that the working temperature of the retorts should be as near 625° C. as can be arranged with safety. This, of course, necessitates an elaborate system of pyrometers. It would not appear that the system, as originally put in, was the most satisfactory, and this has undergone modification to a considerable extent. Pyrometers have been placed horizontally through holes drilled in the vertical flanges and ribs of the retorts in three positions, 3 ft. 10 in., 9 ft. 6 in.,

and 15 ft. from the top. They are staggered so as to give some idea of the temperature of the two sides of the retort. The pyrometer leads are connected to two millivolt meters and two switchboards, one set for the 20 retorts on each side of the bench.

The extracting gear, as originally arranged, was thrown into operation from the base of the retorts. This was found not to be entirely safe, because it was possible for the gear to be left in action after it had done its required work, with the result that the retort was largely emptied into the coke chamber. In order to have the coke extraction under exact control, it was arranged to work the gear from the retort platform.

The retorts are operated on the semi-intermittent principle. At intervals of one and a half to three hours, depending on the coal being treated, a portion of the carbonized fuel is extracted from the retort into the coke chamber. Usually about 5 ft. 6 in. of the charge depth is so removed, and this is replaced through the top valve from a travelling skip.

The gas and oil vapours are led off from the top mouthpieces by take-off pipes to the two collecting mains of 15 in. diameter, which lead into a 20-in. foul-gas main.

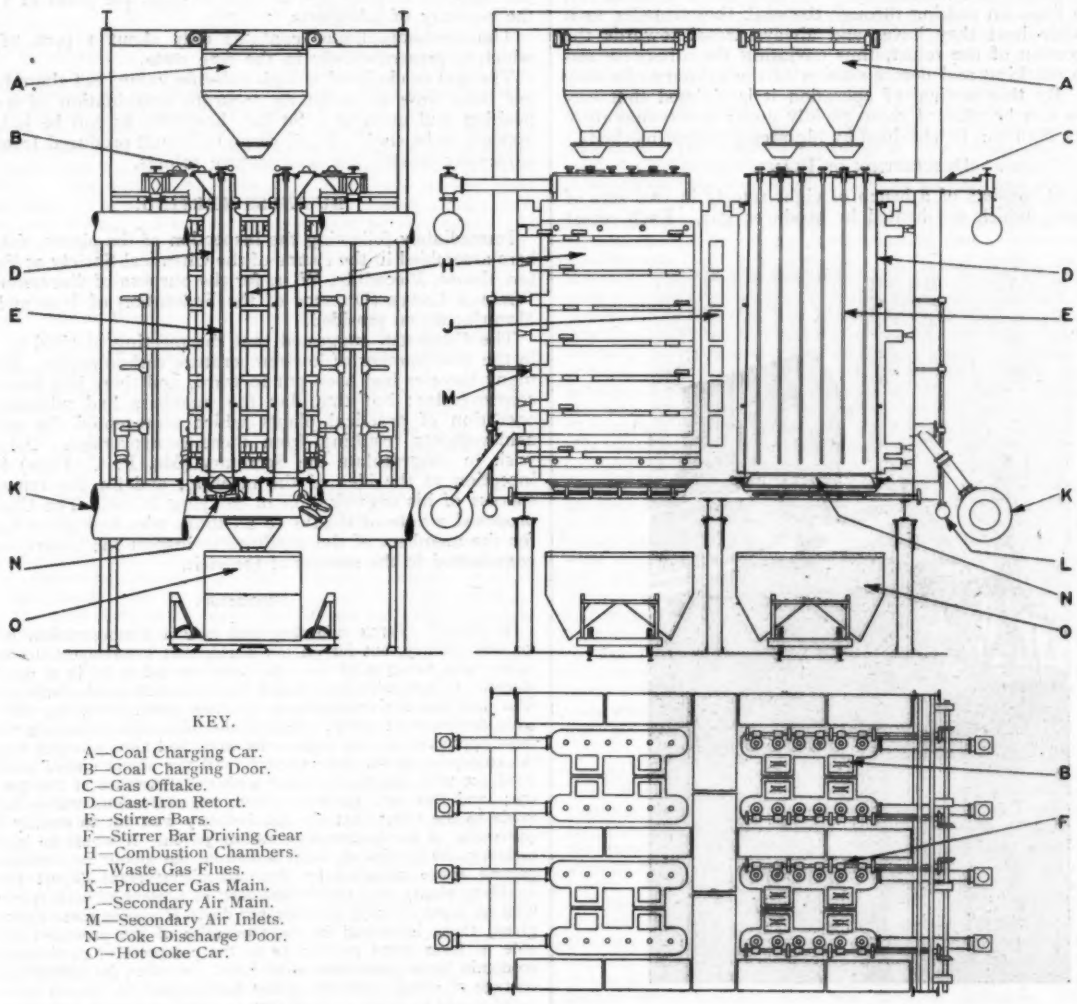
THE HIRD PROCESS.

This Hird plant was installed by the Woodall-Duckham Companies for British Carbonized Fuels, Ltd., at the Richmond Works of the Gas Light and Coke Company.

When it was ascertained that facilities could be obtained through the medium of the Gas Light and Coke Company for the development of the Hird system of low-temperature carbonization, and it was decided to instal a commercial unit of plant at their Richmond Works, it was recognized by the owners of the process that such an installation would involve a very great step from the small scale plant on which experiments were carried out some years ago to a plant of commercial dimensions.

The owners of the process, however, had such confidence in the Hird principle that they took the plunge, and built the plant which is at present installed at Richmond.

As was only to be expected, various troubles arose, but none of them so far has proved difficult to overcome, and the experience gained to date indicates that in a very short time the plant will yield results as regards output quite in accord with the original expectations.



KEY.

A—Coal Charging Car.
B—Coal Charging Door.
C—Gas Offtake.
D—Cast-Iron Retort.
E—Stirrer Bars.
F—Stirrer Bar Driving Gear
H—Combustion Chambers.
J—Waste Gas Flues.
K—Producer Gas Main.
L—Secondary Air Main.
M—Secondary Air Inlets.
N—Coke Discharge Door.
O—Hot Coke Car.

Means are provided for controlling the gas flow in the foul main.

The gas passes into annular-type air-cooled condensers, capable of treating 960,000 c.ft. of gas daily, and thence to the gas exhausters, followed by the usual sequence of tar, ammonia, and sulphuretted hydrogen removal apparatus.

Coal is brought by railway wagon to the plant and delivered by a jigging feeder into a 25-ton per hour single-roll crusher.

The crushed coal is passed over a ⅝-in. screen, and the oversize elevated by a 15-ton per hour elevator to overhead storage bunkers above the retort benches for feeding the retorts.

The fines are delivered to a "Yeadon" briquetting plant of 10 tons per hour capacity.

The briquettes are of the ovoid type of 3 oz. each, and are also delivered by elevator to a special compartment of the overhead storage bunkers.

The carbonized fuel, which has been named "Gloco," is discharged into self-discharging trucks running on rails beneath the retorts. These are removed to the end of the retort house, whence the truck body is transported by automatic telpher to the grading and screening plant.

One of the first troubles to arise was in connection with the stirrers, but this was very quickly overcome. Then followed a difficulty in discharging the solid product from the retorts, due to its sticking to the sides. This has now been eliminated, and a really good class solid smokeless fuel is being produced, but a longer carbonizing period is required than was anticipated. To overcome this, a modification is being made to the heating system (which has been the chief cause of the trouble, owing to uneven heating of the retorts, giving very high temperatures at the top of the setting and temperatures too low for carbonization at the bottom), as a result of which it is anticipated that the present carbonizing time will be reduced by at least one-half.

As further experimental work may be necessary, it has been decided to concentrate all new development on one retort, and as soon as that is in satisfactory operation (which is expected to be within the next few weeks), the whole plant will be modified in a similar manner, and should then have a throughput in accordance with the original expectations.

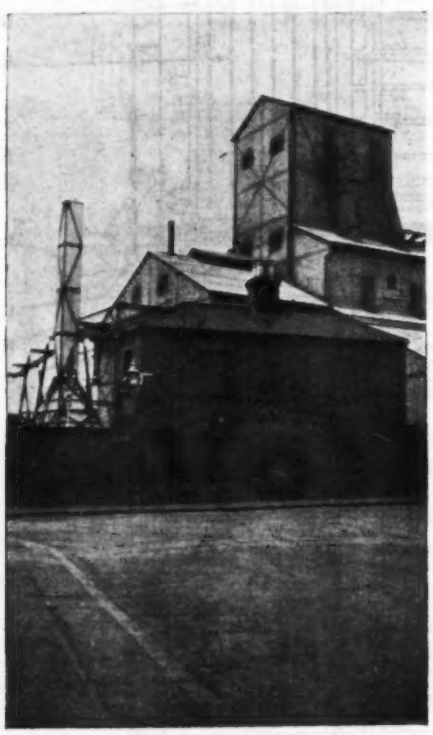
The basic idea of the Hird process is to provide passage ways through the coal charge during carbonization for the rapid

and easy exit of the gases and vapours produced, and at the same time to consolidate the charge in the retort. This is accomplished by means of rotating pokers or blades of a suitable cross-section which maintain cavities in the centre of the coal charge. These pokers are fitted in the retorts at approximately 12-in. centres, the number being dependent upon the horizontal length of the retort. The retorts themselves are of the vertical type, made of a special grade of cast iron, tapering internally from top to bottom and fitted with a special type of discharge doors at the bottom, which latter, when opened, allow the coke to fall out of the retort by gravity. The temperature in the flues surrounding the retort is maintained at 620° C., and special heating arrangements have been made so that the metal of the retort is not in contact with any flame.

After the retorts have been charged, the coal nearest to the retort wall softens and a plastic layer is formed, which, being practically impervious to the passage of any gases generated, tends to prevent such gases passing up between the coal charge and the side of the retort, as is the case in high-temperature ovens. These gases are therefore compelled to travel inwards, and find an easy course through the uncarbonized coal to the cavities which are maintained by the revolving pokers in the centre of the coal charge, and which provide a ready exit for them. At the same time, on passing through the coal, they transfer to it any sensible heat they have, and always travel towards the coolest portion of the retort, thus obviating the otherwise unavoidable cracking and decomposition of the primary oils they contain. By this method of operation it is claimed that carbonization can be effected more rapidly under low-temperature conditions than can be obtained by high-temperature methods.

Description of Plant.

The plant consists of a bench of eight retorts in two sets of four retorts, which are heated by producer gas. Each retort



Coal Bunkers and Retort House.

is 14 ft. high by 6 ft. 6 in. by 10 in. wide at the top, tapering to 14 in. at the bottom, fitted with six pokers, which are suspended from the top of the retorts and extend to within 3 in. of the bottom. The pokers have a diamond cross-section, so that when revolved they form a hole, the area of which is larger than the cross sectional area of the poker. The pokers are operated by worm and worm wheel drive, and make a complete revolution every two minutes. The plant is used to carbonize the small coal or slack from run-of-mine coal after all the lumps have been screened out, or, in other words, that which passes a ½-in. screen. The small coal is elevated into overhead bunkers (two bunkers being provided, one for each set of retorts), from which it is drawn as required into cars of 2½ tons capacity for charging the retorts. A small compartment is also provided in these cars for coke breeze, as a small quantity is charged into the retorts previous to the charge of slack coal. The pokers are revolved during carbonization, the power required to operate each set of six being only ¼ H.P. Carbonization of the 2½ ton charge is complete in 24 hours, after which the bottom door is opened and the carbonized fuel dropped into the coke car; the door being then closed and a fresh charge put into the retort. The charge of hot coke is then run under the quenching tower, where it is quenched with water. The gaseous and volatile matter pass off from the retort into the hydraulic main, where the heavy oils condense; the gases passing on to coolers as in ordinary practice.

The smokeless fuel produced is hard and dense, and, being free from bubble structure, about 1¾ cwt. can be filled into an ordinary 1-cwt. gas coke bag. The volatile content of this solid residue is about 8 p.ct., and, as practically no breeze is made, the whole of it is saleable as domestic fuel.

The low-temperature oil obtained from the condensers appears to be a true primary oil, free from emulsion, containing only 1 p.ct. of water, and having a specific gravity of 1·03. It is entirely free from tar and solid carbon, and can be washed with caustic soda for removal of tar acids without previous distillation. The need for tar distillation and the consequent formation of pitch is thus eliminated. The low-temperature oil contains approximately 30 p.ct. of tar acids; the remainder being light spirit and neutral oils. It should be added that the neutral oils can be distilled to dryness without cracking, which fact appears to have special interest from the point of view of the recovery of lubricants.

The ammonia liquor contains only about 1 p.ct. of NH_3, which is present chiefly in the free state.

The gas made is of a high calorific value, but there has not yet been time to make an accurate examination of its composition and quantity. So far, however, as can be judged, it appears to be similar in all respects to that produced from other externally heated low-temperature retorts.

BUSINESS MEETING.

Immediately following the inspection of the plants, the members assembled in the rooms of the Chemical Society at Burlington House, Piccadilly, W. 1, for the purpose of discussion. Sir William Larke (Director of the Federation of Iron and Steel Manufacturers) presided.

The Chairman suggested that the meeting marked an epoch in the development of low-temperature carbonization. Hitherto many theories had been put forward, and there had been many controversies; but that day the members had witnessed the operation of practical plants which represented the technical achievements resulting from those controversies. All would wish to congratulate the Secretary (Mr. P. C. Pope) for the inception of the idea of the meeting, and for the remarkable success of his organization in carrying it out. The Chairman proposed a vote of thanks to all those who had given facilities for the members of the Institute to inspect the plants and had contributed to the success of the visit.

Discussion.

Dr. E. W. Smith said they had now a demonstration, not only for this country, but for all the world, that low-temperature carbonization was being tried out on a commercial scale in a number of places. Congratulations should be expressed particularly to those who had had the enterprise to provide opportunities for this large-scale development work. One of the outstanding features was that these opptortunities for large-scale work had been provided largely by the enterprise of the gas industry. All the plants visited were being tried out with the goodwill and with the assistance of the gas industry; and this fact gave the lie to the statements which had been made to the effect that the gas industry was out to stultify the development of low-temperature carbonization. It would be interesting to know, he continued, what would be the labour requirements, the ground space occupied by the carbonizing plant (apart from the auxiliary plant), and the capital cost, of a plant of each type to deal with an input of (say) 500 tons per day. If approximate figures were given, those interested in the economics of the processes would be able to form some opinion as to the prospects of producing on an economic basis smokeless solid fuels. Further, he asked what percentage of small material, below half-an-inch in size, it was anticipated would be made by each type of plant, accepting that all material above half-an-inch in size was of equal value and could command a first-class price in the open market.

Mr. W. H. Patchell (Past-President of the Institution of Mechanical Engineers) said it would also be useful to have a technical balance-sheet of the different processes, showing what each could produce from a ton of coal, and also to have particulars of the temperatures at the various stages in the different plants.

Life of "K.S.G." Drums.

Mr. H. M. Ridge asked for information as to the life of the drums used in the "K.S.G." plant. These drums constituted a most interesting feature of the plant. He understood they were made of ordinary open-hearth mild-steel plates; and, in view of the conditions prevailing, the questions naturally arose as to whether distortion would occur, and whether there would be an accretion of material on the inside. It was gratifying to note that the efforts of Dr. Lander and his staff at the Fuel Research Station had been crowned with success by the large-scale operation of the plant at Richmond, because the Research Board had been attacked in the past. With regard to the "Salermo" retort, he asked for information as to the results achieved with the installation at Heinitz, which was working on a comparatively large scale. He also asked for information as to the temperature and other conditions in the retort,

the amount of labour required for the operation of the plant, and the costs. If it were known how many man-hours were required per ton or 100 tons of fuel, one could make calculations as to the probable costs of operation of the plant in different localities.

Mr. A. H. LYMN expressed regret that the "K.S.G." plant inspected at Greenwich had not been in actual operation at the time of the visit, and recalled that when he had visited a plant of that type at Karnop, near Essen, it also was out of action temporarily. On the occasion of his visit to Karnap, however, he had investigated very fully the particulars of the operation of the plant, and also the financial results. Books were laid before him showing the prices obtained for the coke (which was screened to different sizes), the prices allowed for the coal, &c.; and under the conditions prevailing there undoubtedly a profit was made. At the time of his visit, something had gone wrong with the drum, and the plant was not in operation for some weeks afterwards. It was rebuilt, however; and he believed it had worked quite well since. Generally speaking, it appeared to him that there was a tendency on the part of the protagonists of the different low-temperature carbonization processes to fix fancy prices for the products. The whole essence of these things was obviously the price of coal and the price of the coke produced, but he had never yet seen a case in which the figures had been worked out on the basis of an ordinary market price for coke. It was on that basis that they must be judged, for the bye-products would not fetch enormous sums of money.

"K.S.G." PLANT AT KARNAP.

Dr. G. W. ANDERSON remarked that when he had visited the Karnap installation of the "K.S.G." plant some years ago, on behalf of the South Metropolitan Gas Company, it was working; it was producing an excellent fuel, and was giving entire satisfaction in Germany. Subsequently, he believed, it had been shut down in view of the economic conditions prevailing there. The plant at Greenwich was out of action at the time of the visit of the members of the Institution because the fan in connection with the producer had failed. The fuel produced by that plant was a very good domestic coke. The structure of the plant represented a marvellous piece of engineering, but one felt that it must be very costly. In order to be able to judge of the success of the processes, however, one must have information not only of the initial costs, but of the costs of operation. It should also be borne in mind that the different processes set out to produce different fuels. The "K.S.G." and the Fuel Research Board's plant obviously catered for the domestic market, whereas the "Salermo" plant catered for the industrial user; and one could not compare two types of plant which catered for different markets.

Mr. R. MACLAURIN suggested that the solid fuel produced by the Hird process might be an excellent fuel for use in the foundry, because it was extremely hard, and should not break down to the same extent as did some of the more brittle cokes. He asked if it had been used for foundry work.

CRITICISM OF THE "SALERMO" PROCESS.

Mr. JOHN ROBERTS, after an expression of thanks to the inventors for having given facilities for the inspection of their plants, said it was unfortunate that three of the units inspected were not actually distilling coal at the time of inspection. However, anyone who had had anything to do with the development of new systems would appreciate the difficulties to be met; and he did not think that any of the difficulties that had been observed were such as could not be overcome. For example, it was noticed that there was a considerable leakage of volatiles from one end of the "K.S.G." plant. The difficulty of overcoming this was not insuperable, because not very many hours previously he had left a new plant which had an absolutely perfect seal. Mr. Hird's difficulties in the matter of heating would also be remedied in due course; and he had no doubt that the principle of that process was sound. All these processes had been worth trying. In a friendly criticism of the "Salermo" process he could not understand a statement that the flexibility of the plant made the process adaptable to a wider range of materials, varying from water-rich lignites and slurries to strongly coking coals, and that in the latter case the re-circulation of part of the semi-coke had solved a very difficult problem, as such coals could not as a rule be treated directly without pre-treatment. After all, the fuel being manufactured was going to be mixed with coal in another retort, and why circulate semi-coke in order to make a semi-coke for further re-circulation?

Mr. A. SADGROVE, referring to the statement that figures should be given of the costs of the various plants on the basis of an input of (say) 500 tons of coal per day, said it was important to state, when giving such figures, whether the plants were working at full capacity. He understood that in the "K.S.G." plant some portion of the "cooked" material was put through a second time, and it was important that a note should be made of any fact of this kind when working to a common denominator. Further, he understood that the Gas Light and Coke Company were putting through something like 70 tons per day, but it was not clear whether this was for both sets of retort or only one, and he understood that it was hoped to put a very much larger amount through the same retorts in the future.

Mr. PENDENNIS WALLIS asked what was the life of the superheater tubes in the "K.S.G." plant, and whether they had suffered from such oxidation.

Mr. J. W. REBER asked what amount of fuel was consumed in the working of the plants.

Mr. G. H. ROBUS drew attention to the fact that the men operating the Fuel Research Board's type of plant were working under excessively hot conditions, and he asked if it would not be possible to reduce the temperature.

Mr. C. H. MCCALE, commenting on the statement that the best results with the "K.S.G." process were secured when the coal to be carbonized was in a finely divided condition, so that all small coal, including the finest dust, was available for treatment provided it had the necessary coking quality and was free from excess of ash, asked whether a non-coking coal, if blended with a coking coal, could be treated by this process. As to the statement that the semi-coke produced by this plant from a highly swelling bituminous coal was dense, hard, and highly reactive, he suggested that by pre-treatment this coal could be made suitable for the process. Finally, he asked whether any of the semi-coke had been subjected to the shatter test, and whether it would withstand, with undue breakage, the handling to which such materials were subjected in transport.

MAINTENANCE AND CAPITAL COSTS.

Mr. T. CAMPBELL FINLAYSON emphasized that maintenance costs must not be dissociated from capital costs, because though, by reason of refinement of plant and material, the capital cost of a particular unit might be appreciably greater than that of another, it might occupy a more favourable position in the ultimate balance-sheet by reason of lower maintenance costs.

Dr. C. H. LANDER (Director of Fuel Research, Fuel Research Board) took the opportunity to point out the objects of the experiments with the Fuel Research Board plant at Richmond. They were experiments on a commercial scale, following a considerable amount of pure technical investigation on a plant which, though large, was not large enough to indicate the results which might be achieved with the process in practice. After negotiations between the Gas Light and Coke Company, the Trades Facilities Board, and the Government, the Company had selected for the purpose of a commercial trial the process developed at the Fuel Research Station, if assisted by a Government guarantee. He emphasized that the plant was not looked upon by the Research Board as in any way competitive with any other plant in the United Kingdom, or even in the world. The plant was installed at Richmond as the result of a succession of circumstances. Soon after the war, when the Fuel Research Station was started at Greenwich, the Board was asked to help to elucidate a number of problems, and one of those was the problem of low-temperature carbonization. The mere establishment of data on the basis of experiments on quantities of a few grammes or a few hundredweights was of very little help to anybody engaged in industry and who wanted to make a profit from some commercial process, so that in addition to obtaining data on a small scale—which, of course, was a very necessary function of any research organization—one of the main objects was the obtaining of accurate data on a large scale. On the Fuel Research Board's plant there was no patent whatsoever. He did not wish to make any reflection on the gentlemen who held patents of processes, because they had the fullest right to do so—and, indeed, they had to do so—but deliberately nobody had any vested interests whatever in the Board's type of plant. On that account it would probably die a natural death very soon; but it would have served its object if it provided some data to all those who were working on the same problem—and the Board believed it had already done so. The method of heating adopted, for instance, in one type of retort was worked out with data supplied *in toto* from that obtained by the working of the Richmond plant. He personally hoped that the Board's plant would be a back-number in five years' time, but that the data obtained from it would be used. There were far more data available than could possibly be published. With regard to the requests which had been made for data as to the costs of plants, and what they could do, he pointed out that the plant had to be worked, that it had to be tuned up, and that it was necessary to go beyond the stage at which it would break down. Those connected with the plant had their own ideas as to costs and as to what it would do, but accurate data in this respect could not possibly be forthcoming for another two or three years. The labour costs had to be reduced, because when starting up new plant one always made certain that there was enough labour on it, and so on. He ventured to think that, with regard to ascertained data, other people were in the same position.

REPLIES TO THE POINTS RAISED.

Capt. J. FRASER SHAW (Chief Engineer and Officer-in-Charge, Fuel Research Station) replied to the discussion concerning the Board's plant at Richmond, and emphasized, in the first place, Dr. Lander's remarks that the plant was the first erected, and that the expense in connection with it, therefore, was probably much greater than would be the expense of running similar plants in the future. As to the capacity of the Board's plant at Richmond, he said there were 40 retorts, each of which was supposed to be capable of dealing with 3 tons of coal per day, making a total of 120 tons per day. The capital cost—this was an outside figure, and included the cost of such condensing plant as exists, and the briquetting plant—was in the region of £70,000, which worked out at about 39s. per annual ton carbonized. That was definitely excessive. The ground space required was such as one might consider to be satisfactory when compared with that occupied by other plants; it was 8500 sq. ft. (71 sq. ft. per daily ton). He believed ordinary gas-works practice was considerably in excess of that.

The SECRETARY: That includes condensing plant?

Capt. SHAW agreed; but said that it did not include gasholders.

Dr. E. W. SMITH asked if the capital costs could be given for the condensing plant only.

Capt. SHAW said that he had given a figure to include the briquetting plant and the condensing plant because in this case the briquetting plant was an integral part of the whole, but he could give the separate figures, but would include them in the report when published in the Institute's Journal.

Quoting figures obtained from the Gas Light and Coke Company's records of the plant (which compared not unfavourably with the results obtained from the working of two retorts almost exactly similar at the Fuel Research Station, where absolutely accurate measurements of all that went in and all that came out could be obtained), he said that at present only 24 of the 40 retorts at Richmond were in use, and each was dealing with from 2½ to 2¾ tons of coal per day, instead of 3 tons. The gas made per ton of coal was from 6000 to 7000 c.ft.; the calorific value was from 660 to 800 B.Th.U. per c.ft. The number of therms per ton was from 48 to 49; the semi-coke (called "Gloco") made per ton of coal treated

was 13 cwt., and there was also 2 cwt. of breeze. (He imagined that that 2 cwt. was obtained through ¾ in. mesh, and that the quantity of breeze would be less if ¼ in. mesh were used.) A variety of Yorkshire and Durham coals were treated—Horden nuts, South Hetton nuts and double nuts, Felling, Silksworth, South Hetton unscreened; and about 10 to 15 p.ct. of briquettes, which, of course, included a certain amount of pitch from some of the different sorts of coal, though not all. The sizes of coal fed into the retorts were roughly from ¾ in. to 2 in. The coke to producers at present was 4 cwt. per ton, which was appallingly high; but it would not be so high if the full bench was working and if all conditions were correct. It must be reduced; and he believed it would be reduced to not more than 2 cwt. per ton. In the retorts at the Research Station at Greenwich there was actually used 25 therms of gas per ton of coal—that was about equivalent to 2 cwt. of coke. This figure of 25 therms per ton was a fairly substantial one, but the setting at the Research Station was an isolated unit of two retorts only, and one would presume that in a larger setting the heat losses would be cut down, and, therefore, that one would require less than 25 therms per ton. The amount of tar obtained per ton of coal at Richmond was between 17 and 22 gallons. The tar analysis was:

Sp. gr. as received, 1·084. Sp. gr. dry tar, 1·090.
Water, 3·2 p.ct. Ammonia, free 10·4; fixed 0·3.
Distillation: Up to 200°, 3·34 p.ct. .. Tar acids, 0·66 p.ct.
200°—270°, 25·44 ,, .. ,, ,, 10·22 ,,
270°—300°, 8·41 ,, .. ,, ,, 1·8 ,,
Free carbon, 2·3 ,,

The amount of ammonia per ton of coal was 12 gallons if of 10 oz. strength, but actually the strength of liquor was only from 3 to 5 oz. He was not certain that the danger in regard to the liquor from low-temperature processes was realized. In very few low-temperature processes was it possible to get liquor that was usable; and he was afraid that, instead of being accounted an asset, it would have to be accounted a loss, because it would have to be treated if it were to be got rid of, in most cases, though not all. The labour costs at Richmond were extremely high at present—*i.e.*, between 6s. and 9s. per ton. This was hopeless, but it was expected to be reduced to something like 5s. per ton. It was due largely to the heat on the top of the retorts, which would have to be overcome by better ventilation. It had been so bad during hot weather in the summer that the men had not been able to work the retorts as they should. There had been a vicious circle. The retorts were not working so well as they should, and the men had had to work them longer, and had found it more and more difficult. The total amount of "Gloco" sold since starting up the plant was about 5000 tons, and the present price was 43s. per ton.

The Secretary: That includes cartage and delivery?

Capt. Shaw said it was the price at which it was actually delivered to people in Richmond. The volatile matter in the "Gloco" was in the region of 10·3 p.ct., but at the Fuel Research Station the volatile content of the fuel was about 7 or 8 p.ct.; apart from this, the yields obtained at the Station from the two retorts were very similar indeed to those obtained at Richmond.

He was unable to give exact temperatures relating to the Richmond plant. There was rather an elaborate pyrometer outfit there, but he believed that in any future attempt a different and less expensive arrangement could be made. On the retorts at the Research Station there were four pyrometers, one situated 3 ft. 6 in. from the top of each retort, and the others at intervals of 5 ft. below. The temperatures at the different levels from the top downwards for the two retorts were:

1 . . .	595° C.	..	583° C.
2 . . .	590° C.	..	600° C.
3 . . .	609° C.	..	605° C.
4 . . .	598° C.	..	602° C.

There were combustion chambers inside the walls, and the temperature in them were very much higher than in the other side of the walls where the retorts were. The temperatures in the combustion chambers were:

—	A.	B.	C.
1st waste-gas chamber . . .	900°	910°	900°
No. 5 combustion chamber . .	1030°	1040°	1030°
No. 4 ,, ,, . .	750°	760°	750°

With regard to the heat at the top of the retorts at Richmond, he admitted frankly that it was not expected to be anything like so great as it had proved to be. He could only attribute it to a large extent to the fact that the setting was very broad, and that it was difficult to get the air across to the centre. It was hoped to get over the difficulty.

As to the strength of the coke, he said he would add in writing some information as to the results of the tests. A great deal of coke produced at the Fuel Research Station had been sold, however; and if the breeze were taken out of the coke before it was sold, there was very little breaking down afterwards in ordinary delivery.

He could not give figures with regard to maintenance, but this problem was considered very carefully when the Research Board's retorts were designed. The designers had aimed at simplicity and low working costs, and if these could be secured, the maintenance costs would probably be reduced to the minimum.

Particulars of the "K.S.G." Plant.

Mr. S. McEwen, replying to the discussion on the "K.S.G." plant, expressed regret that the plant was not actually working when it was inspected by the members of the Institute. It had been working continuously, night and day, for four weeks, but had failed unexpectedly at 3 o'clock on the morning of the members' visit. The failure had nothing to do with the carbonizing plant, however; the trouble was a small fan in connection with the gas producer. The leakage of gas from the top of the retort, referred to by Mr. Roberts, was due to the fact that, when the exhausters were shut down, the plant was full of coal and was continuing to make gas. There was a distinct pressure within the retort, and glands which normally had to withstand ordinary atmospheric or balanced pressure had on this occasion to withstand the pressure of the gas manufactured.

With regard to capital and working costs, labour requirements, &c., he said he did not propose to anticipate what the future would show. Before the plant was erected at the South Metropolitan Gas Company's Works, very careful estimates were made of the capital costs, working costs, and maintenance charges, based on the experience gained as the result of several years of practical operation of the "K.S.G." plant in Germany. The conditions in this country were different from those in Germany, however, in many respects. The estimates of yields, revenues, and costs had all been tabulated very carefully, and they had indicated a good working profit; otherwise his Company would not have incurred the cost of installation. Only the future would prove whether those estimates were correct. During the next six or nine months of operation a careful record would be kept of all expenses on labour, maintenance, &c., the cost of all materials used, and the revenue received in respect of the products; and the record would establish either the accuracy or the inaccuracy of the original estimates. He was confident, however, that the Company would be able to show a satisfactory profit, because the fuel made so far was equal to, or better than, that made in Germany, and he was satisfied that the Company would secure for it the revenue estimated. The revenues from the other products had all been estimated at conservative values, but until actual figures were obtained in respect of a sufficiently long period of continuous working, it would be a waste of time to give figures to indicate what was expected.

With regard to fines in the coke, and the references made to the return of semi-coke to the retort, he said, that, as a matter of fact, his Company had succeeded, over periods, in returning the whole of the fine dust to the retort with the coal. The advantage of this was that the coke produced was denser than that made from raw coal alone. Usually, about 10 p.ct. of the weight of the charge was in the form of fine coke breeze dust, below ¼ in. The amount of fines produced varied a good deal with the conditions of operating. During the last four weeks' run, the fines below ½ in. amounted to 7 or 8 p.ct., but on previous occasions it had been as high as 14 or 15 p.ct. If the percentage were kept below 12 p.ct., they were able to consume in the retort all their own coke dust below ½ in.; and the balance, between ¼ in. and ½ in., would be available for gas producer or other purposes.

Dealing with Mr. Patchell's request for a technical balance-sheet, he said that again he would prefer not to anticipate the results, but to wait until a reliable balance-sheet could be produced, based on a long period of working—say, three or six months. He could give figures as to the quantity of coal treated and the quantity of products obtained during a run of a few hours, but that would not be the whole story. In the course of commercial operation a plant might be shut down for an hour or two, during which period there would be change in regard to the gas made, the heating efficiency, and so on; so that until the plant had been operating for a long period one could not give reliable figures.

With regard to the drum used on the "K.S.G." plant, he said that a prolonged and careful investigation had been made of the metals available and of their behaviour. The first retort drum made at Karnap about five years ago had failed after two years' continuous operation. This had been built up of mild-steel plates, welded in places, and riveted; the rivets had failed. The drum as now made had not a single rivet. It was 70 ft. long and 10 ft. in diameter. The welds were hammered gas welds, and after two or three years operation there was no deterioration of the metal. Corrosion was trifling, and there was no warping. The method of heating was partly responsible for that. There was no free oxygen in the heating gases, and the retort was heated uniformly from one end to the other, so that there was no distortion or undue strain at any part. The Company were confident that the life of the drum would be sufficiently long to enable them to show a satisfactory profit from its operation.

The temperature of 500° C., to which the steam was superheated, was very high; but he emphasized the fact that the superheater worked at practically atmospheric pressure, and for this reason they did not need great tensile strength in the apparatus. It was not fair to compare a superheater which had to withstand a temperature of 500° C. at a low pressure with a boiler which had to withstand a lower temperature, but a pressure of several hundred pounds per square inch. Experience in Germany had proved the superheater to be entirely satisfactory.

With regard to the treatment of non-coking and coking coals, he said it was possible to mix with a highly swelling coal a non-coking coal and produce a satisfactory domestic coke, but the amount of non-coking coal which could be so added must be determined for each individual coal. There was no golden rule; it was a matter for trial in the laboratory, and it was possible to forecast thereby the results that one might reasonably expect.

The "Salermo" Plant.

Mr. A. T. De Mouilpied, replying to the discussion with regard to the "Salermo" retort, stated, in the first place, that the Salermo Company had welcomed the opportunity to enable the members of the Institute to inspect the plant. Referring to the question of capital costs and labour, he said he felt sure his remarks would not be interpreted as an attempt at evasion, but the retort at Fulham, which was already more than obsolete, was built to deal with one ton of coal per hour. It dealt with one ton of non-coking coal per hour, and about 15 or 16 cwt. of coking coal. The units on the Saar dealt with from 35 to 40 tons of coal per day of 24 hours, but the unit now being built, and which the Company considered to be a desirable standard, was to treat 75 tons in 24 hours. It was not yet complete, but it was on the basis of that unit that the Company would ultimately fix capital costs; and it would be misleading to attempt to estimate them. So far as labour was concerned, he said that at Fulham it

was found that two men were ample to operate the retort; and he was confident that two men could work a much larger retort. As to ground space, he said the 75-ton retort—apart from accessories—would occupy an area of 50 ft. by 20 ft.

Discussing Mr. Patchell's request for a technical balance-sheet, he said that he had given, in his paper describing the "Salermo" plant, records of a run of some days' duration at Fulham on Durham (Wearmouth) coal, and the loss was shown to be 0·8 p.ct. It was a test similar to those applied at the Fuel Research Station, for the same kind of period, during which everything that could be measured was measured. As to temperatures, he said that at Fulham the maximum temperature in the coal itself was 550° C., and the maximum temperature in the vapours was 500° C. Coals had been treated at lower temperatures, but those figures were the maxima. In the furnace the temperature was from 800° to 900° C. The heat required was of the order of 12 therms per ton of coal carbonized. These figures were obtained as the result of repeated measurements.

Replying to Mr. Roberts' criticism that the plant was not working at the time of the inspection by the members, Mr. De Mouilpied said that it was stopped in order that the visitors might be able to see the remarkable motion of the fuel in the retort, which he regarded as by far the most interesting feature.

With regard to the use of semi-coke in the retort, he said it was obvious that when a strongly coking coal was dealt with in this retort there must be a certain degree of agglutination and a certain resistance, and that resistance could be reduced very much indeed by the use of paddles moving slowly. At the same time, it was thought that it might be an advantage to mix with the coal some of its own semi-coke, partly to dilute it and partly to increase the conductivity; and no doubt it did increase the conductivity. They were well on the way to arriving at the treatment of Durham coal without blending with semi-coke at all.

Finally, dealing with operating costs, he said that, for labour, supervision, power, water, steam, and repairs, the cost was from 4s. to 4s. 6d. per ton of coal at Fulham, though when a strongly coking coal was treated the costs were a little higher.

Mr. SALERNI referred to the working of some "Salermo" retorts in the Saar district. There were five retorts, he said, of which four were working generally, the other being held in reserve. The thermal efficiency was very good, and they could treat a ton of coal, containing from 16 to 18 p.ct. of moisture, with 12 therms. The semi-coke produced contained 13 p.ct. of volatile matter, as an average. This volatile content was required because the coke was used for blending purposes with Saar coal to produce a good metallurgical coke.

Each retort treated about 40 tons of coal per day on an average. The semi-coke was blended with the coal as it came from the retorts. The tar was said to be the best ever produced there.

THE HIRD PLANT.

Mr. HIRD, dealing with the Hird installation at Richmond, said that since it was started there had been trouble continually through heating, and the point at which it had occurred mostly was about 3 ft. from the bottom of the retort. Coal usually contracted after a certain temperature was reached during carbonization, but in this particular case this contraction had not occurred, and the result had been sticking of the charges. It was found, however, that when the bottom 3 ft. of coal was removed from the retorts, the coke would discharge. Various attempts had been made to overcome the trouble, but none had been satisfactory; and an alteration to the setting had to be made.

Discussing the advantages of low-temperature coke—and he referred particularly to that produced by his own plant—he remarked that when it was burned in a brazier there was very little smell of sulphur. This advantage was of particular importance. With regard to oil, he emphasised that by the system under which the Hird plant worked—passage-ways were provided down through the centre of the coal in the retorts by means of revolving pokers—the products of carbonization were taken from the retort without decomposition. The result was that the oil produced was free from tar and free carbon, and it was in such a condition that it could be worked up without previously being submitted to distillation. If one had to distil the oil in order to remove the pitch content before it could be worked up, one lost a good deal of the heavy oils, which served as lubricants.

The solid fuel produced by the process had not been used for foundry purposes yet, but an experiment had been carried out in which the fuel was used in a steam wagon, and it was found that the bulk consumed per day was about the same as when Welsh steam coal was used. Whereas when using Welsh steam coal, however, it was necessary to clean out the fires twice a day, when the semi-coke was used the wagons would run for three days without clinkering.

He was not in a position to give further figures regarding the Hird plant.

The CHAIRMAN, after expressing thanks to the speakers who had replied to the discussion on the various plants, said that, as one who had been connected in early life with developments in another branch of engineering activity, he endorsed the caution they had all exhibited in giving estimates which were not backed by sufficient experience. The greatest encouragement he had derived from the discussion was the knowledge that the speakers had promised to publish their working results as soon as reliable figures were obtained.

CERAMIC SOCIETY.

Refractory Materials Section.

The Twenty-First Meeting of the Refractory Materials Section of the Ceramic Society was held on Sept. 18-19 at the Midland Grand Hotel, London. The fourth meeting of the Building Materials Section took place simultaneously, partly as a joint meeting and partly in separate sessions. The President of the Society, Mr. W. J. GARDNER, occupied the Chair, and was supported by a large gathering of members from various parts of the country.

The first paper read was by Mr. G. LAVELLE, B.E., on

DRYING CLAY GOODS.

Following upon some introductory observations, it is explained that the process commonly termed "drying" has the removal of moisture as its ultimate object or as only one of its ultimate objects, and that the efficiency of drying operations depends upon evaporation, vapour pressure, and air circulation.

An up-to-date drying equipment consists mainly of a centrifugal fan discharging conditioned air at high velocity through converging nozzles fixed near the ceiling along one side of the kiln. These jets induce a secondary air current, of three or four times the volume, which becomes intimately mixed with the air from the nozzles. On reaching the opposite side, the air is deflected downwards along the wall and horizontally backward through the articles to be dried. Some space must be left for ejector circulation in the front and back and below the ceiling. A return air duct should also be provided, as about 95 p.ct. of the air in the kiln is returned to the mixing chamber and redistributed to the nozzles. The air is conditioned by drawing it through automatically controlled heaters and water sprays; and the utilization of return air saves much fuel.

The conditioned air supplied to the drier should furnish the heat, which becomes latent in evaporation, and should quickly remove the saturated water vapour to allow further evaporation to go on.

The rate of evaporation of moisture from different materials depends largely on (*a*) the vapour pressure of the moisture in the material (corresponding to its temperature), (*b*) the vapour pressure of the moisture in the air (corresponding to its dew-point temperature), (*c*) the effective velocity of the air over the surface of the material, and (*d*) the physical and chemical properties of the material. The first two factors can be controlled by regulating the difference between the wet and dry bulb temperatures of the conditioned air. As regards (*c*), it is important to avoid the presence of still air in contact with the ware.

The drying schedules which have proved most successful with ceramic products are based on the assumption that first there should be a conditioning period for raising the temperature of the material without loss of moisture. If the air used at first be too dry, evaporation occurs, and the latent heat of evaporation is provided largely at the expense of the material which gives off moisture from its surface, the necessary heating being thus retarded. The shrinkage period which follows is the most important period of the drying schedule, for, when it is ended, there is no further danger of cracking, &c. During the shrinkage period, the relative humidity is lower, and the dry bulb temperature higher. The last period of drying can be carried on under the lowest humidity conditions practicable. The moisture content of the material should be reduced below 3 p.ct. before firing.

With regard to automatic control, for all kinds of ceramic ware, the "Thermotyme" instrument is the only one which gives the same schedule for every run irrespective of loading of the drier and varying temperature conditions outside the drier. This instrument embodies in one case two variable thermostats, one controlling the dry bulb temperature by admission of steam to the heaters, and the other the wet bulb temperature through a steam spray or other humidifying device. The control setting of these thermostats is changed as required, according to a predetermined schedule, by means of cams driven by a clock. The automatic setting of the thermostats by the cams is more accurate than by hand, and the changes are independent of human operators. The wet bulb is also regulated by an air lever motor operating the return air and fresh air dampers.

To ensure uniform drying, the ware should be arranged so that the air gets uniformly distributed throughout the material. Scientific drying—by means of conditioned air—produces the desired results in a much shorter time than "natural" drying. The equipment dries every batch in the same time, irrespective of weather, season, or location, and every piece is of the best quality.

The next paper, read by Mr. H. PARDOE, was entitled

HOT PATCHING.

Bottle-tightness of retorts in the gas industry, &c., can only be assured if tightening is possible when the temperature of

the plant is at working heat. In the case of gas retorts, the deleterious effects of a slight leakage on the thermal yield and on the various residuals are well known. There is also the risk of local overheating of the setting, and the reducing effect of gases near the leak, among other dangers.

The consideration of hot patching and repairing refractory constructions at working heats falls naturally under the headings of (*a*) an effective method of application, and (*b*) hot patching materials. Under (*a*) are included (1) spraying surfaces, (2) paddle or peel patching, (3) air guns, and (4) detonator guns.

Spraying surfaces of refractory walls periodically prolongs the life of the construction. It acts as a preventive, and should not be classified with hot patching. It is noteworthy that a highly refractory material, working at a moderate temperature, becomes very hard on the face when treated with a wash of suitable material; such hardening not penetrating the brick appreciably, but producing a case-hardening effect which renders the surfaces almost immune from erosion. Whitewashing machines, with nozzles of different shapes, have been used with some success, but the delivery tube and nozzle are apt to become fouled in the hot zones. Better results were obtained with a spraying machine combined with air pressure.

Paddle or peel patching has been done successfully with horizontal retorts, but even experts find it very difficult to patch successfully a vertical chamber. It is comparatively easy to patch ordinary fireclay work with a peel, and to get adherence in a fair percentage of cases; but the silica and high silicious materials now more commonly used are much more difficult to deal with.

Air guns of two types have been operated successfully. One has its air chamber at the muzzle end of a long tube, the piston being coupled by a rod to the spring and releasing device at the stock end. The slurry holder is attached to the air chamber, a bursting diaphragm separating the slurry from the air. Upon releasing the spring, the diaphragm soon bursts, and the slurry is projected into the cracks under repair at about 35 lbs. per sq. in. This gun can give good service, for operating accurately at long ranges in a vertical position. The other air gun is a simple arrangement of tubes with a slurry holder and bursting diaphragm at the muzzle end of the tubes, the other end being coupled up to the air service main. When the diaphragm bursts (after the air-cock has been opened) the slurry is projected into the cracks. The best results were obtained at about 30 lbs. per sq. in.

Detonator guns gave promise of the most serviceable results. The first design was found to present difficulties in use. The perfected design is a light but robust arrangement of action and cartridge extractor outside the retorts, while the barrel, with its easily adjusted lengthening pieces, is connected with the slurry holder. The pressure produced in the barrel by firing the blank cartridge soon bursts the diaphragm, and the contents of the slurry holder are projected at a velocity sufficient for penetration into the joints to the full depth of the bricks. With spare nozzle-pieces and slurry holders available, it is possible to fire two or three shots per minute, and always on the target.

Hot-patching materials should be characterized by (*a*) adhesion upon contact with hot surfaces; (*b*) a catalytic ingredient which will combine with the original material and form a bond at working heats, but with a long softening phase; (*c*) a coarse-mesh ingredient pre-calcined in a proportion which produces a nearly constant degree of expansion of the whole; (*d*) a compounded whole which will not reduce the refractoriness of the original, but will definitely reduce abrasion from the moving charge and the formation of slag on the refractory walls; (*e*) a mixture which will carry the least possible water content to give the desired plasticity, thus reducing tendency to steam off or cause spalling.

These conditions were found to be best met by compounding:

Fine silica sand (200-mesh or less)	3 parts
Pre-calcined bauxite grog (10 to 20 mesh)	2 ,,
Powdered plate glass (100-mesh)	3 p.ct.
Powdered vegetable glue	2 ,,
Lime	1½ ,,

The presence of glue gives effective adhesion upon contact and holds the cement in position until bricking is well advanced. The glass induces catalysis at about 1150° C., and the lime content causes "bricking" of the patch. The final melting temperature is about 1550° C., and the original brickwork does not become softened below that temperature.

The above makes a most effective ramming mixture, and is suitable for quite large repairs to full brick dimensions for cold patching. This material has also been tried on a paddle with success, but if the material is applied under pressure it is forced into the cracks to the full depth of the bricks. The atomizing of the slurry when air pressure is used gives a relatively even surface to the face of the walls.

When spraying hot surfaces, it was found desirable to apply the mixture at slightly below working temperature; and a much better case-hardening effect is produced if after spraying the temperature can be raised slightly above working temperature before putting it into service.

Thermal Inefficiency of the Cement Rotary Kiln.

A paper bearing the above title was read by Dr. Geoffrey Martin. It deals with results obtained in the course of research made some years ago. From tabulated data it is deduced that: (1) An ideal kiln, subject to no losses of any kind, could produce 100 tons of cement clinker by the combustion of 6·36 tons of standard coal. (The ordinary rotary kiln is supposed to do well to produce 100 tons of clinker for 28 tons of coal, and sometimes 40 tons of coal is actually used per 100 tons of clinker.) (2) In an actual rotary kiln the practically observed flame temperature corresponds nearly with the theoretical output of clinker appertaining to that temperature. (This implies that the gases have given up all their effective heat to the raw material, but it is quite exceptional.) (3) The higher the flame temperature of the combustion gases, the greater the clinker output per pound of coal burned.

The practical applications of these facts are so bound up with various patents and confidential information that the author merely remarks that any British manufacturer who works with a fuel consumption of more than 22 tons of standard coal per 100 tons of clinker produced should be ashamed of himself.

Molybdenum Wire-Wound Furnaces.

This paper is contributed by Dr. C. Sykes, and concerns certain special electric furnaces for high temperatures.

Microstructure of Some West of England Silica Bricks.

Under this title, Mr. J. M. Coon described the results of investigations made on bricks produced from mixtures of material derived from the kaolinization or decomposition of granite rocks. The interest of the paper was greatly enhanced by an excellent series of lantern slides.

Effect of Non-Plastics (Grog) on the Shrinkage and Porosity of Fireclay in the Unfired State.

This was the joint work of Mr. S. R. Hind, B.Sc., and Mr. F. Wheeler, and is an extension of previous studies of the drying properties of a special clay. Numerous tabulated data are supplied, and also a series of graphs. The following is a brief abstract of the paper.

Previous work is reviewed, and the dependence of the essential relationships on the relative volumes of clay, grog, and water present in the body is emphasized. Linear measurements of contraction, carried out in the usual way, may lead to error in practical application. The ultimate (dry) porosity of a plastic clay made up to varying initial consistencies is not affected seriously by such variation. Decrease in the size of grog in 30 p.ct. mixtures increases the ultimate porosity slightly, and the amount of tempering-water to a more serious extent. The increase in tempering-water was found to be consistent with the postulate that the volume of additional water was proportional to the square root of the surface factor. The ultimate (dry) porosity of mixtures with a porous and with a non-porous grog was comprehensively investigated. With non-porous grog the porosity decreased in a linear manner with increasing grog content up to 60 p.ct., after which it increased up to that given by the packing density of the dry grog alone. The same critical point occurred at 60 p.ct. grog with porous grog, but the decrease in porosity was slight. After this point the increase was rather greater than with non-porous grog.

The apparent specific gravities of the same mixtures reflected the same features, but less definitely.

A new method of plotting contraction data is explained. From such a graph the linear contraction for any percentage of grog and initial consistency may be read off directly. It is shown how the decreasing tempering-water required with higher proportions of grog entirely obscures the fact that contraction increases with grog content if the percentage of tempering-water is maintained constant. The volume contraction of mixtures of ordinary working consistency was found to be proportional to the percentage of clay present. There is apparently no systematic difference in this respect between mixtures made with wet or with dry grog. The shrinkage-drying curves show that the presence of grog arrests the contraction of the clay at an earlier point, giving an increased porosity between the grog particles, even though the porosity of the mixture as a whole may show a decrease. A moderate allowance of time for maturing, followed by re-mixing, seems to assure that porous grog becomes substantially saturated. The data indicate that the clay particles do not penetrate into the pores of a porous grog, and that mixtures containing porous grog will take appreciably longer to dry than where non-porous grog is used. Hence the drying of pieces made with porous grog will be safer, because of lower moisture-gradients due to the earlier penetration of air into the ware.

COAL CLEANING BY GRAVITY SEPARATION.

Brief Description of the Lessing Coal-Cleaning Plant erected by the Clean Coal Company, Ltd., at the Yniscedwyn Colliery of Amalgamated Anthracite Collieries, Ltd.

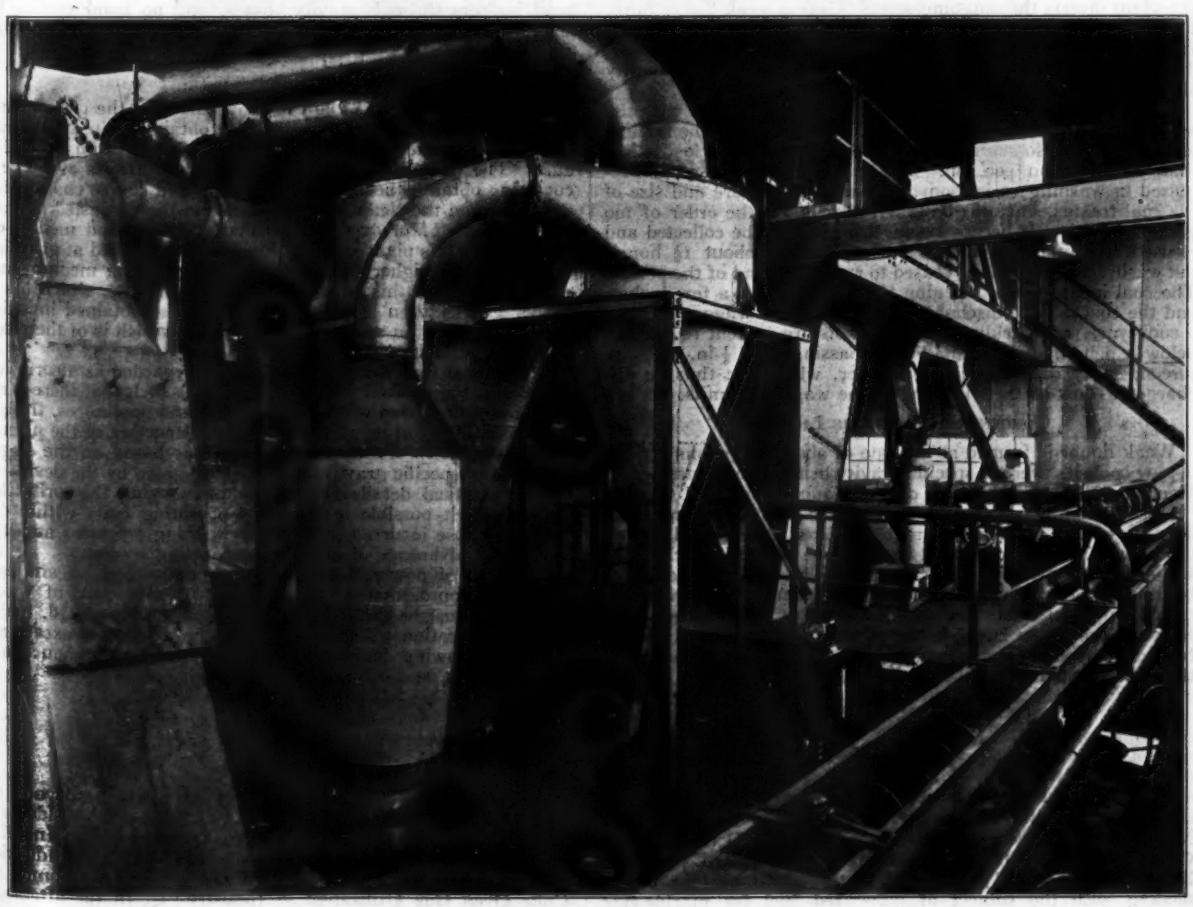
[From "Colliery Engineering."]

The raw coal is delivered into a concrete ground bunker, of 25 tons capacity, provided with an adjustable feed to the main elevator. At the top of the elevator is a bunker from which the coal is fed to the primary air separator by a duplex feeder. The air separator is virtually a long column, through which an upward current of air is drawn, running practically the whole height of the building, and into which the coal is introduced some distance above the bottom outlet. A separation is effected, the dust being carried upwards by the air current to a cyclone, while the de-dusted material is delivered to a hopper at the bottom of the column. A controllable proportion of medium fine material, containing a certain percentage of oversize, is extracted through an outlet in the upper portion of the primary air separator and collected in a bunker. This material is fed into the lower portion of the secondary air separator operating in a manner similar to the first. Here the separation is practically complete, as the separator is dealing only with a small proportion of the raw coal. As an additional precaution to prevent any of the coarser particles from reaching the second cyclone, an expansion chamber, provided with baffle plates, is arranged at the top of this column. The fines from both cyclones go to the same hopper, automatic discharge valves being provided on the ends of the chutes to compel the dust to build up and thus form a natural air seal. Coarse coal from both separators drops to the boot of an elevator and is raised to a hopper at the top of the building for discharge into the gravity separator.

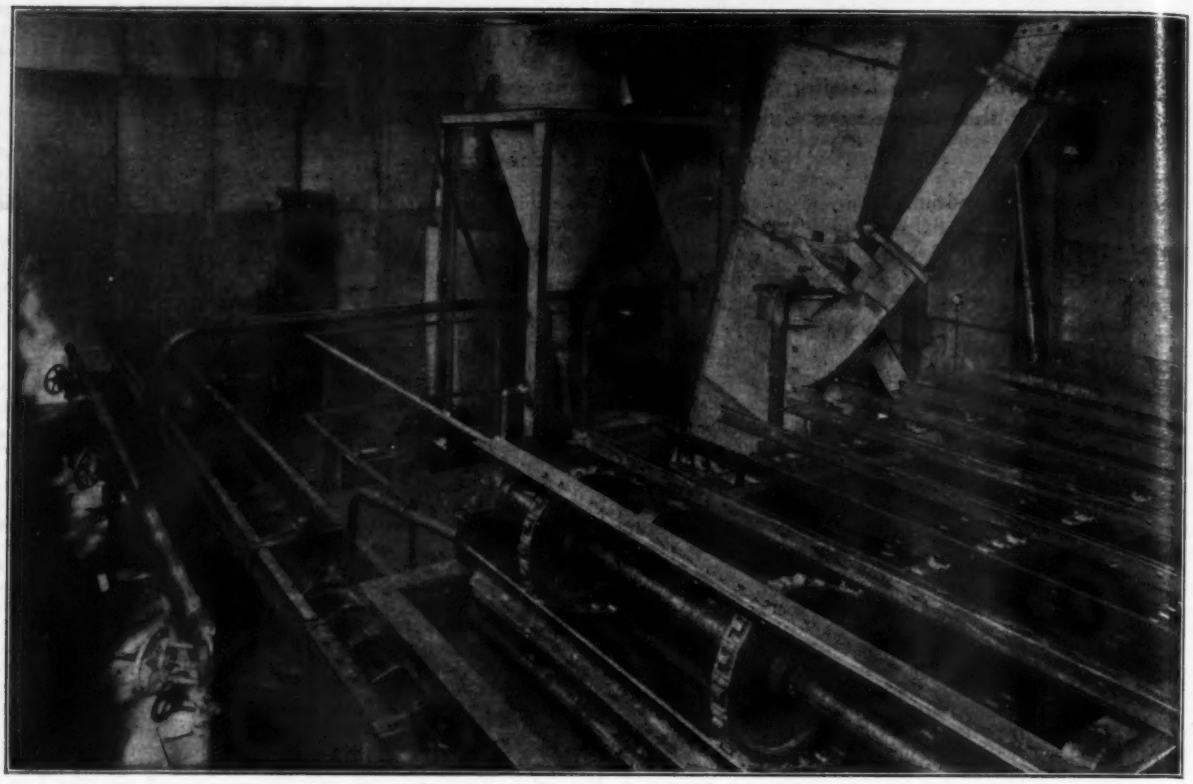
Normally the air is returned from the cyclones to the fans in closed circuit. The efficiency of dust removal is, however, not affected whether working with open or closed circuit. The air separators are so arranged that the air leaving the cyclones may be discharged through vent pipes in the roof, and it has been found that under such conditions the amount of dust discharged into the air is scarcely visible. All bunkers and chutes are sealed and dust-tight, so that there is no dust escaping into the building, and the cleanliness maintained throughout the plant is a distinguishing feature of the process.

This type of air separator affords a closed system free from external dust troubles and hence is not subject to special Government regulations. It effects a sharp cut between the dust and the coarse coal, and requires very little ground space and low power for running. Furthermore, it has been designed to give such air velocities at different points of the system as will allow the desired products to be obtained, and it is automatically controlled to compensate for variations in the coal feed, which would otherwise cause changes in the rate of air circulation.

The dust-free coarse coal is introduced to the middle of the gravity separator by two feed pipes. The separating vessel has a cylindrical body, a conical base, and a rectangular top. The clean coal rises to the top of the separator, forming a kind of mat, and is removed by a continuous scraper conveyor which passes it over a draining grid. Here some of the surplus liquor is drained off and is led to a sump from which it is returned to the feed pipes. The clean coal, which still contains about 20 p.ct. of liquor, is delivered to a spiral conveyor and taken to one of three drainers. These are vertical cylindrical vessels 30 ft. high and 8 ft. in diameter arranged with coned bottoms and suitable outlet valves. Two similar vessels are provided for the dirt, which is raised from the bottom of the separating vessel by an elevator provided with a water-tight casing. At the top of the drainage vessels are clean water sprays, which are turned on when the vessel is full. The clean water travels evenly down the full length of the vessel and gradually replaces the liquor in the interstices between the particles of coal or dirt as the case may be, the liquor by reason of its higher density being subject to only very little dilution. Owing to the previous removal of the dust from the coal, drainage takes place at a relatively rapid rate, the bulk of the liquor being drained off at its original strength and passed by way of a float control tank to the strong liquor stock tank. During the drainage process there are thus three more or less distinct zones of fluid in the



TOP OF DE-DUSTING PLANT AND GRAVITY SEPARATOR.



TOP OF GRAVITY SEPARATOR.

vessel, the lower consisting of full strength liquor, the upper consisting of pure water, with a comparatively shallow zone of weak liquor between. Sufficient water is added in this way to wash the coal or refuse entirely free from chloride. Immediately the diluted portion of the liquor reaches a float control tank at the bottom, an electrical signal is operated, and the attendant diverts the outgoing solution into a weak liquor tank. The specific gravity of the solution now falls very rapidly, and, at a predetermined point, a second float signal is operated, when the remaining liquid, which contains only a negligible quantity of calcium chloride, is passed down the waste-pipe.

One of the chief difficulties anticipated in connection with the whole process was the conservation of the liquor, but the method used has proved so successful that the actual amount lost is less than half-a-gallon per ton. The quantity of fresh water required in washing varies somewhat with the nature and size of the coal treated, but may be taken as being of the order of 100 gallons per ton. If necessary, most of this can be collected and re-used. Drainage of the coal occupies only about 1½ hours, the washing water having ceased to run at the end of the period. The coal is run out by opening the bottom valve a few inches, and the coal may be discharged either direct to wagons or upon a conveyor. So quickly is the free moisture content reduced to below 5 p.ct. that even small coal, passing (say) ¼-in. or $\frac{7}{16}$-in. screen, easily runs out of the drainer, which can thus be discharged as fast as the trimming of the wagons permits.

Concentration of the Liquor.

Weak liquor is formed at the rate of about 70 gallons per ton of raw coal, its average specific gravity being approximately 1·2. Heat for the concentration of the liquor is derived from a "fuel" obtained from an old refuse heap which contains about 60 p.ct. of ash. From this material, gas is generated in two producers and burned under two loco-type boilers. Each boiler has a rated evaporative capacity of 2500 lbs. of steam per hour, but, no doubt largely due to the efficient method of firing, their actual output of steam can be maintained at 20 p.ct. above this figure. The steam is conducted to a simple tubular evaporator heated by 4000 lbs. of steam per hour, the sensible heat from the concentrated liquor being employed, by means of a small heat exchanger, to pre-heat the incoming weak liquor. The liquor is concentrated to the specific gravity required, and is run into a stock tank, to be re-circulated through the gravity separation plant. The producers are equipped with ash-sluicing gear, and with rocking grates and rolls to break up and remove the clinker continuously. They are fed from overhead hoppers through gravity chutes, and no hand stoking is necessary. One man is thus able to run the whole of the evaporating plant.

Operating Results.

The results from this plant are, by reason of the process employed, practically identical with those obtainable in the laboratory float-and-sink test, when preceded by screening out the dust. The fundamental principle employed permits of a sharp cut being obtained between the fine dust and coarse coal on the one hand and the clean coal and refuse in the de-dusted portion on the other. Moreover, the particular design and method of operation of this plant permits this cut to be applied at gravities which may be higher than that of the separating medium employed. It is for this reason that even anthracite, which has a higher gravity than bituminous coal, can be obtained in satisfactory yield with a minimum ash content, which is of the order of 2 p.ct. or under.

Though calcium chloride is commonly regarded as a corrosive substance, the method of dealing with it is such that there is no evidence of corrosion of the steel vessels and appliances, though no special alloys are employed in the construction of the plant.

The simplicity of the process, which is based on the single principle of specific gravity, and the care given by the designers to the practical details of the plant employing this principle, have made it possible to keep the operating costs within the limits of those incurred in ordinary washing processes and still retain the advantage of improved separating results.

The cost of power, washing water, liquor loss, steam, and labour is approximately 5½d. per ton of raw coal, of which about ¾d. must be debited to the air separation and 4¾d. to the gravity separation. The total capital charges do not exceed 2d. per ton, allowing for interest, depreciation, maintenance and repairs, rates, and insurance.

Institute of Fuel Conference.—The annual two days' conference of the Institute of Fuel will be held at the Institution of Mechanical Engineers on Thursday and Friday, Oct. 24 and 25. On Thursday Sir David Milne-Watson, LL.D., D.L., will deliver his Presidential Address, and there will be four papers dealing with the subject of pulverized fuel for marine-type boilers. The annual dinner and dance will take place in the evening. The morning session on Friday will be devoted to gas. Sir Arthur Duckham, K.C.B., G.B.E., will preside, and papers will be presented by Mr. J. S. Atkinson ("The Installation and Operation of Gas Producer Plants for Industrial Furnaces") and by Mr. E. C. Evans ("The Economics of Coke Oven Gas Utilization in Industry"). In the afternoon the discussion will centre round refractory materials.

DRY CLEANING OF COAL.

Static Washer Embodying New Principle.

The static dry washer process of coal cleaning depends upon a new fundamental principle in the pneumatic method by which the coal and stone are stratified. By this principle full advantage is taken of the compressive properties of air, and, in fact, this process is—state the manufacturers, Dry Washers (Coal and Minerals), Ltd., of Sunderland—the only dry system which is fundamentally dependent upon gaseous elasticity for its operation. Hitherto, the methods of application of air to stratification have been suggested by the principles underlying the wet methods; and until the introduction of the static dry washer the full potential advantages to be gained by the proper application of air pressure were not realized. The washer is able to clean coal of mixed sizes without preliminary screening.

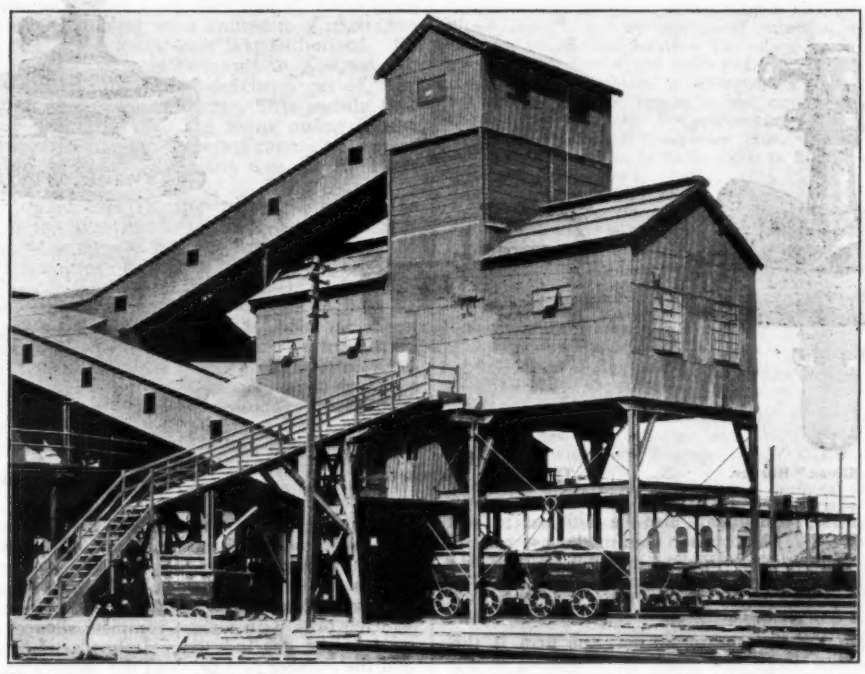
The plant is designed so that the air pressure is applied statically to the coal bed, instead of dynamically, this method having the remarkable capacity of rendering the coal bed "liquid" in its action, so that the stone particles sink through it and stratification ensues. The process is also novel in the manner in which the coal and stone strata are separated. The "liquidity" of the coal bed causes it to flow forwardly along the slightly declined table, and cleaned layers of coal are successively skimmed off until only the stone remains, the final discharge of which is controlled by an adjustable chute.

The deck is of trough form and constricted at two points, thus dividing it into three rectangular cells each narrower than the one preceding. Discharge points are provided for each cell, the reduced width of the one following allowing the remainder of the coal to be maintained at the correct depth. Perforated steel sheeting forms the floor of each cell; the deck surface being quite plain and free from riffles or guides. Skimmers are provided consisting of V-shaped walls mounted on perforated metal sheeting, for the purpose of separating the strata. The refuse is discharged over an adjustable chute at the end of the table, the quantity being determined by its inclination. A large stationary air chest is provided beneath the table connected, and air-pressure is maintained by a fan which delivers the air through a pulsator. The table has a smooth oscillatory, not propulsive, motion, maintaining the bed at an even thickness and resistance; and the slight slope of the deck allows the bed to flow forward, as a liquid flows by gravity, to the points of discharge.

The storage hopper is made sufficiently large to ensure the regular working of the table, and the coal is mechanically fed across the whole width of the rear end of the table by a feeder of the rotary star type ensuring a positive rate of feed. A variable speed gear is provided for controlling the feed, and a suitable safety device is included in the drive to prevent damage by any large unbreakable object being included in the coal. The whole of the dust in the original coal passes over the table, the statical operation of the pressure allowing of its retention.

From the economic standpoint, the salient feature of a plant of this description is its ability to treat raw coal of about 2 in. down to zero in size without preliminary sizing or other treatment. The process is thus considerably simplified, and the capital and operating costs are substantially reduced. Sizing where necessary can more satisfactorily be performed after than before cleaning.

In practice two men are required to operate a plant of 100 tons per hour capacity. Its compactness and simplicity permit of its economic use for large or small outputs.



STATIC DRY WASHER PLANT AT THE SOUTH HETTON COLLIERY.

Typical average working results taken over lengthy periods from plants at work are:

—	Raw Coal.		Clean Coal.	Refuse.
	Ash P.Ct.	Ash P.Ct. in Floatings at 1·5 S.G.	Ash P.Ct.	Ash P.Ct.
Plant A	11·2	4·2	6·3	71·3
,, B	12·8	4·5	7·6	64·6
,, C	11·9	3·8	6·8	69·7

The free coal in the refuse varies usually from ½ to 1½ p.ct., representing an average loss of one ton of coal per 1000 tons treated. These figures are over-all results, including dust and fine small coal in the sizes treated—namely, 1½ in. to 0—and represent the daily performance of the plants.

When the cleaned small coal is re-mixed with the large hand-cleaned coal, these results allow of cargoes being shipped with over-all ash content of from 5 to 7½ p.ct.

The power consumption on the table at the South Hetton Colliery is 0·85 unit per ton of raw coal treated. This consumption provides for the conveying of coal from and to the Colliery screening plant. In twenty months' continuous working at South Hetton there have not been any stoppages due to mechanical breakdown.

The process is fully protected in all the coal producing countries, and Letters Patent have already been issued in Great Britain, France, Belgium, India, New Zealand, Australia, and Canada.

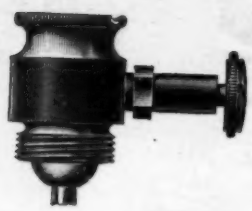
LIGHTING FITTINGS FOR THE COMING SEASON.

Some Attractive Innovations by Messrs. Falk, Stadelmann, & Co., Ltd.

The catalogue of lighting fittings for the coming season, just issued by Messrs. Falk, Stadelmann, and Co., Ltd., of Veritas House, 83 to 93, Farringdon Road, E.C. 1, contains, as usual, quite a number of novel features, and indicates once again the efforts made by the firm to keep abreast of the times, by continuously evolving new ideas.

The new list (No. 622) contains details of many interesting lines in burners and fittings, among which, and one which is illustrated here, is the "Veritas-Silvex" burner, which, as an all-bright burner, was such a success last year. This is now made in similar shape but of brass, so that it can be finished in various colours to suit various coloured fittings. The "Veritas-Duplos" is another burner, differently constructed, with all the parts exposed to the gas made of aluminium. The external part is fitted with a rim round the gallery, made of brass, which can also be finished to suit various coloured fittings. This burner was made last year in the large size, but is now also supplied in bijou size, having proved such a success.

"Veritas-Silvex" Burner.



The "Silux" Adjuster.

"Veritas-Diploma" Burner.

Aluminium Burners.

Coming to the aluminium type of burner, the firm is this year introducing a new large disc made of magnesia in the nozzle. This takes the place of what used to be called "metal gauzes" to prevent back-lighting. The idea of this disc is that it cannot corrode, and, being detachable, can be cleaned; but the chief feature is that the disc is enclosed in such a large mixing chamber that it produces a far better light, at the same time tending to silence in burning.

Another new burner, illustrated here, is the "Veritas-Diploma," which has a new feature in the shape of automatic air supply. The idea is to overcome the difficulty the public is continually up against—viz., air regulation. It requires no manipulation, the burner being so constructed that it automatically takes in the requisite amount of air in relation to the gas consumed. It has been made of bold design, and, in conjunction with the special globe, makes a very attractive burner, and should prove of great utility.

Magnesia Superheaters.

Multiple lighting is gradually becoming more popular, and the magnesia superheater is undoubtedly best for this purpose. The 3-light pattern having been such a huge success, they are being made in 2-light also. The chief idea of having multiple lights, either two or three, is that if one mantle gets broken, the remaining mantles will still give sufficient light, until the broken one can be replaced.

There is also a new line in oblong cluster street lighting burners which are claimed to give excellent results.

A point which the firm particularly emphasize is that their patent "Veritas" gradual action gas adjuster, which is used in conjunction with street lighting burners, should be particularly useful, as it is not affected by vibration, however severe. Gas undertakings have not sufficiently appreciated this particular adjuster in the past, and the makers hope that a more general use of this apparatus will have beneficial results to the industry. Another innovation is the patent "Silux" adjuster, which works with almost complete silence, and fills a long-felt need in the gas industry. It has a multiple-grooved plunger, and the number and depth of the grooves are variable according to the pressure.

Another lighting fitting of unique design is the "Veritas-Trilux," which, together with the "Super-Veritas" purelight unit, produces a powerful, steady light, not injurious to the eyes, and scientifically distributed, the mantles being completely hidden from view.

Many other types of burners and fittings are also comprehensively dealt with in the catalogue, including different kinds of street lighting burners fitted with enamelled reflectors, cluster burners for indoor and outdoor lighting, and pneumatic distance switches. All burners are made at Messrs. Falk, Stadelmann, & Co.'s own works at Birmingham.

UNEMPLOYMENT INSURANCE ACT, 1929.

Though most persons are more conversant with many aspects of unemployment insurance nowadays than at its inception, it is surprising to note the lack of knowledge possessed by both the layman and the lay Press of the finance of these Acts. A short Act, but of more importance than its length, has been passed in the session of the new Parliament which alters somewhat the proportions of the State share to the revenue of the fund.

To understand completely the finance of the fund, it is necessary to remember that there are three sources to the revenue. Contributions are paid by employers in respect of every insured person, by the said insured person, and the Exchequer also adds a contribution in respect of each person. Up to now the share of the latter has been less than that of the two other parties to the full contribution. The total annual revenue of the fund at the passing of the 1929 Act was about £43,000,000, of which £31,000,000 comes from the combined contributions of employer and employee, and £12,000,000 from the Exchequer. This revenue is only sufficient to cover the expenditure arising from a live register of one million or thereabouts; whereas the unemployment register invariably contains quite one hundred thousand more persons receiving benefit. This Act increases the contribution of the Exchequer to one-half of the aggregate contributions of employer and employee, which was a recommendation of the Blanesburgh Committee in so far that they advised an equal share from each of the three sources to the fund. At the present time, however, the employer pays most, though under the 1929 Act the Exchequer will pay one-third of the total contribution. To amplify this somewhat, take as an example the contributions in respect of insured men. At the passing of this Act the contributions were: Employer 8d.; employee 7d.; Exchequer 6d., weekly. Under the present Act, the following proportions will rule: Employer 8d.; employee 7d.; Exchequer (as from April 1, 1929) 7½d., weekly. The ratio in respect of the other classes insured is practically the same.

The effect of this will increase the annual Exchequer con-

tribution to the fund by about £3,500,000. It is expected that unless something unforeseen occurs, this will be sufficient to meet expenditure until the early part of 1930. Meanwhile it is understood that an inquiry is proceeding as to methods of finance, and another scheme is contemplated in the new year.

Postulating that, in modern sociology, unemployment insurance cannot be dispensed with, a compulsory scheme, where the State is responsible for the administration likewise, must involve some contribution from the Exchequer; but up to now, invariably the larger proportion of the revenue has come from the combined contributions of employer and employee. To understand this readily, the following proportions of the contribution provided by the Exchequer from the inception of the payments in 1912 to the present day should be noted. Under the 1911 Act, the share was one-fourth; under the 1920 Act one-fifth; under the 1922 Act rather more than one-fourth; and under the 1925 Act, as amended by the Economy Act, 1926, between one-third and one-quarter, which share has remained until the passing of the 1929 Act under review. From 1912 until July, 1929, roughly speaking the combined totals of the employers and employed contributions came to £302,000,000, and that of the Exchequer £108,000,000.

Though the lay Press from time to time publish particulars of the huge sums paid out in benefits, it might be pertinent to point out that up to now these abnormal amounts have not been a direct charge to the State, but have been met by loans from the Treasury. Borrowing powers were limited to £10,000,000 by the No. 1—1921 Act, when loans were first authorized. By the No. 2—1921 Act, the limit was increased to £20,000,000, and in this Act also was defined the "deficiency period," an expression often used in subsequent Acts. This means that period while there are any outstanding loans owing to the Treasury; and the determining of such period cannot take place until such time as the Treasury can certify that the fund has become solvent.

It was necessary to increase the borrowing powers of the fund by section 7 of the 1922 Act to £30,000,000. This was further increased to £40,000,000 by the 1928 Act, with the proviso that, if circumstances allowed, a reversion on Dec. 31, 1930, should take place to the limit of £30,000,000.

Unfortunately the converse has been the case, as on June 29, 1929, the debt of the fund amounted to £36,620,000, and therefore immediate action was necessary to save the fund from absolute insolvency, hence the 1929 Act was brought into operation. It was practically an agreed measure, and doubtless also embraced the views of expert official opinion. These loans bear interest payable out of the Unemployment Fund, and, up to now, the interest has been at slightly less than 5 p.ct. per annum. It will be seen that the fund is becoming heavily weighted in various ways, and that the interest now payable is in the region of £2,000,000 per annum.

Though the fund is based on actuarial values, it can readily be understood how difficult this is to an actuary, as the basis is trade cycles and recurring periods of prosperity, so, more than in usual insurance, it must be conjecture as to futures. To visualize the position, it should be noted that the 1911 Act included the building, shipbuilding, engineering, and kindred trades only, and with the war intervening with corresponding little unemployment, it can be seen that prior to the comprehensive Act of 1920 the fund never had a real test. The 1916 Act brought in also numbers of munition workers, so that from 2,250,000 insured persons in the 1911 Act, by the passing of the 1916 Act, the figures immediately prior to the 1920 Act were 4,197,000 insured persons. The balance in hand of the fund at Nov., 1919, was £18,900,000, which by the end of 1920 had increased to £21,200,000.

The 1920 Act which embraced practically every trade with known seasonal periods increased the total of insured persons to eleven-and-three-quarter millions, including men, women, and juveniles. Unfortunately for the success of the fund, with the advent of this comprehensive Act came also not only the trade slump, but also the industrial troubles of 1921, so that before revenue had become available for the fund, abnormal expenditure occurred; hence, the only way of saving the fund was recourse to loans, as explained earlier. But in spite of this bad opening, the fund from 1922 onwards was becoming practically self-supporting, and, in addition, contributions had been lowered all round. Then came the trade disputes of 1926, with the abnormal expenditure in benefits and administrative expenses; and the deficit which in April, 1926, had been reduced to £7,100,000, then mounted to over £21,000,000 by December, 1926.

The above figures are illuminating as showing the effect that abnormal periods of unemployment have upon the finance of the fund, and it requires little thought to note the difficulty of promoting any scheme against the risk of unemployment. A factor also to be noted is that when expenditure in benefits is exceptionally heavy, the administration expenses also rise with bigger staffs, &c., and also the revenue drops by reason of the fact that the contributions from the three sources cease in respect of the unemployed insured person, so the fund loses both ways. Given a normal period of employment, however, the fund should become practically self supporting, apart from the State's share of contributions.

It should be remembered that the scheme only includes those trades with known seasonal periods of unemployment.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Determination of Carbon Monoxide.

SIR,—I have read with interest the account published in your issues of Sept. 11 and 18 of the work of Messrs. Vandaveer and Gregg, of the American Gas Association's Testing Laboratory, on the determination of traces of carbon monoxide in flue gases. I can confirm their statement that it is not sufficient to remove water vapour and carbon dioxide from the gases before they enter the iodine pentoxide reaction tube; and we in this laboratory have during the last two years completed the purification by means of the reagent which Messrs. Vandaveer and Gregg recommend—namely, a solution of chromic acid in strong sulphuric acid. Whatever be the impurities which this reagent absorbs (unsaturated hydrocarbons, aldehydes, &c.), there is no doubt that, if not removed, they are able to reduce the pentoxide and cause the carbon monoxide results to be higher than the truth. We have observed that when the chromic reagent is omitted from the train, the phosphoric oxide used for final drying of the gases always develops a faint reddish brown coloration after prolonged use; but when the gases are washed with the reagent, the phosphoric oxide remains perfectly white.

The chromic reagent possesses another advantage, which Messrs. Vandaveer and Gregg do not mention in their paper, in that it absorbs nitric oxide;* and by subsequent reduction with zinc and ferrous sulphate in alkaline solution, the nitrogen so absorbed may be recovered as ammonia and estimated by Nessler's method. Owing to the difficulty of obtaining nitrogen-free reagents, the accuracy is not very high. Our results in test runs have hitherto been within about 5 p.ct. of truth. We are seeking to improve the method, and may publish details at some other time. Meanwhile, we would point out that the presence of nitric oxide in flue gases is important from three points of view:

(*a*) Nitric oxide may affect the accuracy of the determination of carbon monoxide.
(*b*) Nitric oxide is even more toxic than carbon monoxide.
(*c*) Nitric oxide may play an important part in the corrosion of flues, &c., by facilitating catalytically the formation of sulphuric acid from sulphur dioxide.

A. R. PEARSON.

South Metropolitan Gas Company,
Chemical Department,
709, Old Kent Road, S.E. 15,
Sept. 27, 1929.

*[We were compelled, owing to lack of space, slightly to curtail the paper by Messrs. Vandaveer and Gregg. The following, however, completes the authors' findings.—ED. "G.J."

Water Vapour.—The apparatus is designed to absorb all moisture before the sample reaches the iodine pentoxide, but for the purpose of this determination 0·1 c.ft. (2832 c.c.) of nitrogen saturated with water vapour was passed directly into the iodine pentoxide. An indicated amount of 0·003 p.ct. of carbon monoxide was obtained. No satisfactory explanation of this reaction is given at present.

Formaldehyde.—Formaldehyde was prepared by heating paraform tablets used for disinfecting purposes. The gas analyzed 27·3 p.ct. carbon dioxide, 2·8 oxygen, 6·3 hydrogen, 2·8 carbon monoxide, 51·4 aldehydes, and 9·4 inerts. The aldehydes were determined by slow combustion with oxygen. For analysis in the iodine pentoxide apparatus a sample of this gas was used after it had been passed through potassium hydroxide, fuming sulphuric acid, potassium pyrogallate, and the copper oxide furnace.

A sample containing 1·0 p.ct. of aldehydes mixed with nitrogen gave an indication of 0·025 p.ct. carbon monoxide when passed through an apparatus with the chromic acid at room temperature. Cold chromic acid apparently oxidizes aldehydes only partially. When 0·9 p.ct. aldehyde mixed with nitrogen was passed through the apparatus having one tower of chromic acid at 100° C., no indication of a reaction with iodine pentoxide was obtained. This experiment would indicate that heated chromic acid oxidizes aldehydes.

Oxides of Nitrogen.—Though there is considerable doubt as to the presence of appreciable quantities of oxides of nitrogen in the products of combustion of gas, there is, of course, such a possibility. Oxides of nitrogen, mainly nitric oxide and nitrogen peroxide, were prepared by the action of nitric acid on copper. Quantities varying from 0·13 p.ct. to 1·06 p.ct. oxides of nitrogen mixed with nitrogen were passed through the apparatus. In no case was there any indication of a reaction with iodine pentoxide, nor did this amount of oxides of nitrogen affect the satisfactory titration of a known quantity of iodine.]

Extensive New Coal Seam.—The West Clifton Colliery Company, Ltd., are opening up an extensive new coal seam near Morpeth. Known as the "Brockwell" seam, it has a very low ash content, and according to Mr. Granville Poole, of Armstrong College, Newcastle, should prove to be a gas coal. It is not a true coking coal, but should be very useful for blending with coking coal.

Nine-Language Trade Guide.—Following the practice of the last three years, an advance edition of the catalogue of the London Section of the British Industries Fair is being prepared with a classified index to goods, in nine languages. It will be ready on Dec. 31, in time for it to be in the hands of most overseas buyers before they leave their homes for the Fair, which is to be held simultaneously in London and Birmingham from Feb. 17 to 28. This advance edition will run to 11,000 copies.

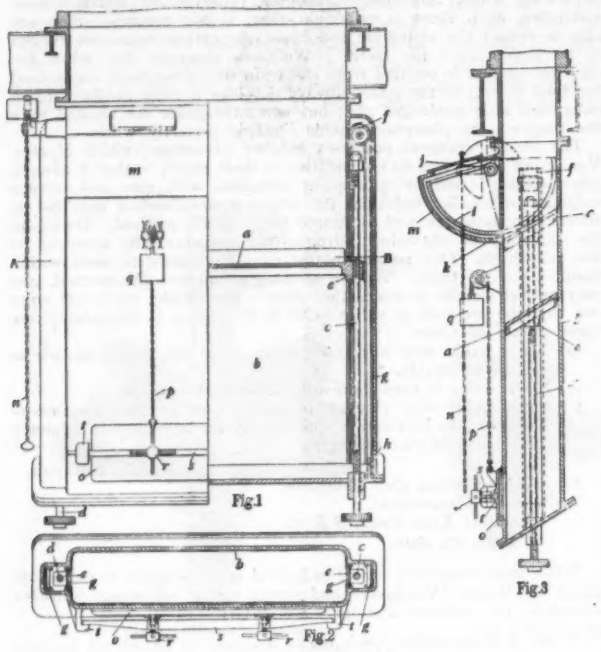
REGISTER OF PATENTS.

Coke Extractors for Glover-West Verticals. No. 317,257.

WEST, E., and WEST'S GAS IMPROVEMENT COMPANY, LTD., both of Manchester.

No. 29,314; Oct. 11, 1928.

This invention relates to coke extractors for vertical retorts. The object is to provide improved extracting means and an improved door for supporting the charge in the retort during the emptying of the coke chamber.



Improved Glover-West Coke Extractor.

Fig. 1 is at its left-hand side an elevation and at its right-hand side a sectional elevation, fig. 2 a sectional plan view on the line A B of fig. 1, and fig. 3 a sectional side elevation. The table *a* within the coke chamber *b* is carried by two screws *c*, *d*, one at each side of the coke chamber, which thread through nut-like parts *e* upon the table ends. The screws which are in recesses in the chamber wall are rotated by suitable means, such as pawl and ratchet gear, to cause the gradual descent of the table while coke is filling into the chamber from the retort above, and the rapid ascent of the table after the coke has been discharged from the chamber. Attached to each end of the table and passing over pulleys *f* above the upper end of each operating screw is arranged a steel belt *g* which is weighted at *h* at its free end so that, as the table is lowered, the belts are pulled downwards within the coke chamber to protect the screws from the hot coke; while they are withdrawn by the weights as the table is raised.

The door *i*, which is adapted to extend across the top of the coke chamber to support the charge in the retort when the coke chamber is being emptied, is of curved form, having its axis of curvature coincident with the axis *j* about which it is moved to its service and out-of-service positions. It is passed through a slot or gap *k* in one side of the coke chamber; and due to its shape and circular movement, it does not merely project across the coke chamber, but extends in an upward direction in the chamber (as shown in dotted lines in fig. 3) when in its service position with its outer face against the wall of the chamber remote from the door axis. When in its out-of-service position, the door is contained within a side chamber or compartment *m*. It is moved to its service position by the chain *n*. By causing the door *i* to have a circular movement, the patentees claim that they minimize the power necessary to move it, as trapping of coke between the door and chamber wall is prevented; the motion of the door merely raising the coke in contact with the edge of the door which comes against the chamber wall.

The extractor table *a* is disposed at an angle, and when in its raised position is tangential to the door *i*, so that there is but little space between the two. Dropping of the retort charge when the door *i* is withdrawn to allow the charge to be carried by the table *a* is therefore minimized.

The discharge door *o* upon the coke chamber is preferably a loose plate carried by chains *p* or the like and counterbalanced by weights *q* for ease of manipulation. Jacking screws *r* are attached to the plate and are threaded through a beam *s* which engages lugs *t* cast on the coke chamber when the door is in position for locking. When the said locking screws are slackened back, the door can readily be removed.

Mechanical Control of W.G. Plant, &c. No. 317,815.

HUMPHREYS & GLASGOW, LTD., and STELFOX, J. C., both of Victoria Street, S.W. 1.

No. 15,123; May 23, 1928.

The object of this invention is to provide improved mechanism of the kind in which a motor directly actuates the operating valves or other parts, and also actuates the mechanism which automatically controls the actuation of the valves.

The lines of the invention will be clear from the two main claims, which are as follows:

1. Apparatus for mechanically operating water gas and other plant wherein the valves of the plant to any number are actuated at the desired rate and times by means of a corresponding number of couplings between the valves and a member continuously driven by an electric or other motor running at a constant speed, the several couplings being controlled by the automatic operator.

2. Apparatus for mechanically operating water gas and other plant wherein an electric or other motor running at a constant speed imparts a continuous to and fro movement to a member carrying a series of pairs of coupling pawls adapted to coact with valve levers directly connected to the valves, which pawls are normally held out of action by the automatic operator and, on release thereby, couple the respective valve levers to the continuously moving member at the required times so that the motor then directly moves the valves in the required directions and at the desired rate.

Water Gas Manufacture.—No. 318,016.

JOHNSON, J. Y., of Lincoln's Inn Fields, W.C. [A communication from I. G. Farbenindustrie A.G.]

No. 26,595; Sept. 17, 1928.

(Patent of Addition to No. 214,544; Sept. 17, 1923.)

This invention is a modification of No. 214,544 [see "JOURNAL," Vol. 166, p. 754] for the manufacture of water gas from a layer of solid carbonaceous material, and in particular of small size, by introducing the gasifying agent into the bottom of the producer in such a manner that the particles of fuel are kept in motion up and down throughout the entire layer, in such a manner as to present the appearance of a boiling liquid. In accordance with that invention, in the step of hot blowing a great amount of heat is carried away by the effluent hot gases, which may be utilized, for example, for the production of steam. The insertion of a heat accumulator above the layer of solid carbonaceous material has also been proposed. "Small size" in the present application, when applied to fuel, means pea to nut size.

The I. G. Farbenindustrie A.G. have now found that water gas can be produced in a very advantageous manner in a gas producer, having a heat accumulator of the kind described, by first blowing the carbonaceous material hot by passing a gasifying agent containing free oxygen, such as air or a gas richer in oxygen than air, therethrough, at such a rate (in particular if the fuel be small) that the fuel particles are set in a rising and falling state of motion, the rising gases thereby heating the heat accumulator, and then passing steam first through the heat accumulator and then downwards through the layer of carbonaceous material (blown hot, as above described); the fuel now being in a state of rest. Another heat accumulator may be provided in a dust separator connected to the gas producer; and this may also be employed for superheating the steam. The grate may also be used for heating the steam, by constructing it of hollow bars and by passing the steam through the bars. The steam may then be passed through a series of tubes, for example, in the lower gas chamber of the gas producer; these tubes being heated by the hot water gas which has just left the charge of coal.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Sept. 18.]

Nos. 27,295—28,005.

ALADDIN INDUSTRIES, LTD.—"Means for supporting upright incandescent mantles." No. 27,896.

DUCKHAM, A. M.—"Doors of coke ovens." No. 27,763.

HUMPHREYS & GLASGOW, LTD.—"Apparatus for removing solid particles from gas." No. 27,495.

HUMPHREYS & GLASGOW, LTD.—"Manufacture of gas." No. 27,496.

HUMPHREYS & GLASGOW, LTD.—"Production of mixed oil gas and water gas." Nos. 27,497, 27,624, 27,625, 27,626, 27,628.

HUMPHREYS & GLASGOW, LTD.—"Metering of gaseous fluids." No. 27,854.

IMBER, J.—See Aladdin Industries, Ltd. No. 27,896.

TURNER, A. L.—"Gas fires." No. 27,807.

WOODALL-DUCKHAM (1920), LTD.—See Duckham, A. M. No. 27,763.

[Extracted from the "Official Journal" for Sept. 25.]

Nos. 28,006—28,698.

STARKIE, H.—"Gas-burning water heater." No. 28,366.

MISCELLANEOUS NEWS.

INSTITUTION EDUCATION SCHEME.

Facilities for External Candidates.

The Regulations, 1929, of the Chartered Institution of Gas Engineers remove all restrictions "as to where or how instruction is obtained, nor is there any time restriction during which the examinations must be passed." This opens up the examinations for all who wish to enter the profession, and makes it practicable for the most isolated student to qualify. In other words, there is now nothing to prevent any young man of real ability from rising to the highest post the industry has to offer.

The Gas College was founded in 1924 with the express object of catering for the requirements of candidates for the profession who for any reason are unable to take advantage of the usual sources of instruction in the various subjects specified as part qualification for the examinations of the Institution. During the past year, the Institution has closed its doors to membership except by examination, but the Education Scheme in its new form makes practicable the provision of equal opportunities for all engaged in the industry to achieve full membership.

With the removal of the restrictions which have hitherto prevented the provision of facilities for external candidates in respect of the ancillary subjects, the Gas College has been re-organized, and its courses have been extended to meet every requirement of candidates for the profession.

The following details of successful coaching by the College are sufficient comment upon the results already achieved and the justification for the extension of its activities.

"Gas College" Successes in the Examinations of the Chartered Institution.

Year.	Gas Engineering.			Gas Supply.		Totals.	Total Awarded	P.Ct. Gained by "G.C." Students.
	Diploma.	Higher.	Ordinary.	Higher.	Ordinary.			
1926.	No candidates submitted	5	6	2	9	22	45	42
1927.	2—2nd class	11	15	1	9	38	69	55
1928.	3—1sts, 1—2nd	10	10	2	16	42	81	52
1929.	3—1sts, 1—2nd	10	16	1	19	50	81	62

Total number of First-Class Certificates, 78. Total number of Second-Class Certificates, 74. 152 External Certificates out of 276 awarded to the whole industry during the four years 1926-29. These successes represent 89 p.ct. of the total number of candidates submitted by the "College."

"Gas College" Successes in the Examinations of the City and Guilds of London Institute.

Year.	Gas-Works Practice (including Science).	Gas Supply Practice (including Science).	Total.	Total Number Awarded
1926.	5 (including 2nd prize)	4	9	14
1927.	9 (including 2nd prize)	6 (including 1st and 2nd prizes)	15	25
1928.	8 (including 1st and 2nd prizes)	6 (including 1st and 2nd prizes)	14	38
1929.	Not yet published	Not yet published	..	..

FEATURES OF THE NEW COURSES.

The syllabuses prescribed in the ancillary subjects under the new regulations are based upon those of technical schools in the same subjects, and the standards similarly are those of these schools. In order, therefore, exactly to meet the requirements, the new courses are being prepared by experts of many years' experience in the teaching of these subjects to these standards in technical schools, and have in addition practical experience in gas-works.

This is the outstanding feature of the work of the College—namely, that the courses are designed to give students not only a grasp of general principles, but ability to apply them to everyday problems in the drawing office, the laboratory, or upon the works. For example, the course in Machine Drawing is based upon the study of a Lancashire boiler, a steam engine, power transmission plant, and a lathe; and the course in Building Construction upon the design and lay-out of a workshop. Moreover, to ensure the successful application of this idea, the studies in the various subjects have been arranged so that (for example) as a student completes the section relating to the properties of steam (Engineering Science) he proceeds immediately with details of construction of a Lancashire boiler (Machine Drawing). This method of dovetailing the various subjects incidentally enables the examinations to be taken by easy and logical stages.

It does not follow from this that a student is expected to repeat any studies he may already have completed. Full allowances are made for these in every stage. A prospectus of the whole of these courses may be had on application to the Principal, the Gas College, Halifax, and full facilities in all subjects are now available.

MEETINGS OF DISTRICT TAR BOARDS.

Fostering Co-Operation.

South-Western District Board.

As mentioned in our columns last week, the South-Western District Board of the British Road Tar Association met at the Plymouth and Stonehouse Gas Light and Coke Company's Offices on Sept. 19—Mr. J. H. ELLIS presiding.

The CHAIRMAN remarked that that was the first meeting of the District Board. The objects of the Association were to produce the best road-surfacing material at the cheapest possible price. It was tar that had overcome the dust nuisance; and to-day it was still the best and cheapest road surface material available.

Mr. W. E. CONE, Technical Adviser to the British Road Tar Association, said the main aims of the Association were to engage in propaganda for the purpose of encouraging and developing the use of tar for road and other purposes, and to obtain additional technical information with regard to the product which would enhance its value. In future the Association would be represented at institutions which were directly concerned with road making. They wanted to develop a close contact with other important organizations whereby there would be an interchange of ideas and opinions with regard to the tar product which would help the work they had in hand. They felt that the setting-up of District Boards would materially assist in enlisting the support of every individual member of the Association. The District Boards had the opportunity of making a careful survey and study of their own local conditions, and would be of material assistance in national propaganda, for which there was an insistent need. Competition in the road-making world was still very severe, but he thought they could say they had a product which in the near future would counteract the competition which faced the industry. It would not do for them to accept the position in too calm a manner, for it was their business to bear criticisms clearly in mind, and to meet them. With a co-operative effort on the part of producers and distillers, they should in due course be able to do that successfully.

Mr. F. KILPATRICK, Director of South-Western Tar Distillers, and a member of the Executive Council of the British Road Tar Association, said the amount of tar sold for spraying roads in Devon and Cornwall was about 100,000 gallons above that of last year. Tarmacadam had taken less than last year, and last year's quantity was less than that of the previous year. Up to that period there had been no question that tarmacadam was a very growing industry, and it was largely used in the two westernmost counties; now, however, the position was not so good. They had introduced a new kind of tarmacadam, which they claimed had considerable advantages. Mr. Kilpatrick observed that a considerable portion of the roads in Devon and Cornwall were being treated with imported American bitumens—the whole of the main roads in North Devon, most of those in South Devon, and a portion of those in Cornwall. Those two Counties were spending between £100,000 and £120,000 a year in the purchase of imported asphalt and bitumens for the purpose of surfacing their roads. There was no reason why that money should be so spent. The only roads which might need surfacing with that material were those which drained into fishery rivers, which were estimated at 5 p.ct. of the whole of the roads of the country, and perhaps 10 p.ct. of those of the two Counties. The roads in Hampshire were about the best in the country. They were treated with tar, and the cost of the treatment was about 2d. a square yard.

The CHAIRMAN said he had been over the roads of Devon and Cornwall, and over those of Hampshire, and he had no hesitation in saying that in every respect the tarred roads were as good as, and in many cases better than, the roads made of foreign material.

Mr. S. J. INGRAM, Managing Director of Camborne Gas Company, and Mr. W. N. WESTLAKE, Engineer and Manager of the Exeter Gas Company, also addressed the meeting.

Sheffield and Lincolnshire Tar Board.

The Second Annual Meeting of the Sheffield and Lincolnshire Tar Board was held in Sheffield on Friday, Sept. 20—Mr. RALPH HALKETT (General Manager and Secretary of the Sheffield Gas Company), the Chairman, presiding.

The CHAIRMAN read his annual report on the work of the Board during the past year, and strongly appealed to coke oven owners to join the Association, in view of the mutual benefits derived as a result of the efforts of the British Road Tar Association. He also made a strong appeal for subscriptions to a fund for endowing a Chair in Highway Engineering at the University of London.

Mr. W. E. CONE, Technical Adviser to the British Road Tar Association, then addressed the meeting on the activities of the Association, and enumerated the many successes achieved and to be achieved.

During subsequent discussion keen disappointment was expressed by Mr. P. B. NICHOLSON and others at the attitude of the West Riding County Council in their continued use of such large quantities of bitumen in preference to locally produced high-grade road tar. This was all the more surprising in view of the area's dependence upon mining, and the benefits likely to accrue to the industry and the community by extended application of tar to road-making.

Mr. G. A. Hebden was appointed Chairman for the ensuing year, on the proposal of Mr. HALKETT, seconded by Mr. G. SNELL; and

Mr. Halkett was appointed Vice-Chairman on the proposal of Mr. Hebden, seconded by Mr. H. E. G. West.

The retiring Chairman was thanked for his services by Mr. Nicholson, seconded by Mr. Snell; and Mr. Halkett thanked the members for their appreciation of his efforts.

It was resolved that the Chairmanship should be held by a coke oven and a gas-works representative in alternate years.

The following were elected to form an Executive Committee:

Coke Oven Representatives.

Mr. T. W. Adam — Mr. P. B. Nicholson
Mr. J. W. Lee — Mr. G. Snell
Mr. H. Bradbury

Tar Distillers' Representatives.

Mr. H. Smith — Mr. H. E. G. West

Gas Representatives.

Mr. E. Hutchinson — Mr. T. H. Brown
Mr. T. Brown — Mr. H. Davies
Mr. J. Baldwin

Mr. F. Cooke was re-appointed Hon. Secretary, and was thanked by Mr. Halkett for his generous co-operation during the year.

SEDGLEY'S GROWING DEMAND FOR GAS.

Inquiry by the Ministry of Health.

Mr. E. Butler, of the Ministry of Health, held an inquiry on Wednesday last at Sedgley respecting that Council's application for powers to borrow £4500 for the development of their gas undertaking.

The projected loan comprises £2500 for new water gas plant and £2000 for mains, services, and meters on the Goldthorn Hill estate.

Mr. T. R. Knight (Clerk to the Council) said that since Sedgley took over the gas undertaking in 1882 loans totalling nearly £41,500 had been raised, including the initial purchase price of £10,000. Of this there was £13,681 still outstanding.

Mr. Butler obtained from Mr. Brettell (Gas Manager) details of the existing plant, which has a maximum capacity of about 300,000 c.ft. per day.

The new plant, plans of which were examined by Mr. Butler, would comprise two units, each with a 75,000 c.ft. per day capacity, which represented a 50 p.ct. increase. It was pointed out that during the last nine years the gas requirements had increased by this amount.

Mr. Brettell said that, subject to confirmation, the Council had decided to place the order with a Midland firm.

GAS ACTS (1920 AND 1929) ORDERS.

SPECIAL ORDERS.

Bolton Corporation.

To increase the maximum price to be charged by the Corporation for gas supplied.

Chorley Corporation.

To increase the maximum price authorized for the supply of gas, &c.

Farnham Gas and Electricity Company.

To authorize the transfer of, and the vesting in the Company of, the undertaking of the Alton and District Gas Company, Ltd., to extend the limits of supply, to make provision as to the price to be charged for gas in the added limits, and to empower the Company to raise additional capital.

Rawmarsh Urban District Council.

To increase the maximum prices which the Council may charge for gas, to empower them to borrow money, and to confer upon them further powers in connection with the gas undertaking.

AMENDING ORDER.

Croydon Gas Company.

As from Sept. 26 paragraph (*a*) of section 3 (standard price) of the Croydon Gas (Charges) Order, 1921, shall be read and have effect as if the words "fourteen decimal eight pence per therm" were substituted for the words "seventeen and four-fifths pence per therm" therein.

SECTION 6.

Keighley Corporation.

The Corporation shall, from April 1, 1930, charge according to the number of B.Th.U. supplied, and shall on or before Jan. 1 give notice of the calorific value of the gas they intend to supply.

Selby Urban District Council.

The Council shall, from April 1, 1930, charge according to the number of B.Th.U. supplied, and shall on or before Jan. 1 give notice of the calorific value of the gas they intend to supply.

DECLARATIONS OF CALORIFIC VALUE.

Bishop Auckland District Gas Company.—500 B.Th.U. (Jan. 1, 1930).

Braintree and Bocking Gas Company, Ltd.—500 B.Th.U. (Jan. 1, 1930).

Clay Cross Gas Company, Ltd.—480 B.Th.U. (Jan. 1, 1930).

Cleveland Gas Company.—460 B.Th.U. (Jan. 1, 1930).

Earby and Thornton Gas and Lighting Company, Ltd.—475 B.Th.U., in substitution for 500 B.Th.U. (Jan. 1, 1930).

Kirkham Gas Company, Ltd.—550 B.Th.U. (Jan. 1, 1930).

Sunderland Gas Company.—500 B.Th.U. (Jan. 1, 1930).

Wateringbury Gas Company, Ltd.—550 B.Th.U. (Dec. 25).

SULPHATE OF AMMONIA.

Prices for Season 1929-30.

Messrs. Nitram, Ltd., of Imperial Chemical House, Millbank, S.W. 1, have issued a circular to buyers of sulphate of ammonia, giving the prices of this commodity for the final three months of the present year.

In fixing these prices, the 1s. per ton rebate on railway carriage which was allowed during a part of last season, to give buyers the benefit of the De-Rating Act, has been taken into account, so that in future no rebate or allowance of this nature will be made.

The right is reserved to raise the prices at any time by sending out a printed notice to that effect. Any such increase in price will apply to all orders received after the date of issue of the notice. There will be no allowance for taking delivery *ex* works.

As practically no ordinary quality is likely to be available, the firm refrain from quoting a price for this quality. It is understood that quantities purchased at the price stated below will be used for home agricultural purposes only.

The firm offer to sell sulphate of ammonia for home agricultural use at the following prices for delivery in:

		£ s. d.
1929	October	9 11 0
	November	9 14 0
	December	9 17 0

per ton for neutral quality guaranteed to contain 20·60 p.ct. of nitrogen by weight and not to contain more than 0·025 p.ct. of free acid (H_2SO_4) and to be in readily friable condition at the time of delivery, delivered to consumer's nearest station or wharf in Great Britain (or c.i.f. main ports for the Isle of Man) for prompt cash payment in lots of 6 tons and upwards, packed in single bags containing about 2 cwt. net to be supplied free by sellers, tare allowed. When credit is given, a reasonable extra charge may be made, but the discount allowed for prompt payment should be quoted on the invoice. The above prices will also apply to deliveries of 1 ton and upwards *ex* works or *ex* store to buyers' road vehicle.

A statement of conditions follows.

AUSTRALIAN GAS LIGHT COMPANY.

Ninetieth Annual General Meeting.

The Ninetieth Annual General Meeting of the Australian Gas Light Company was held in Sydney on Thursday, Aug. 15—Mr. George J. Cohen, Chairman of Directors, presiding.

The Chairman, in moving the adoption of the report, said: The outstanding feature of these accounts is the reduction of the "Carry Forward" by £46,022—a result largely attributable to the stoppage of the Company's normal supplies of coal. The main items of expenditure on the manufacture and distribution of gas during the past year, which show any great variation from those of the previous year, are as follow: Coal, which cost £26,923 more; wages, which cost £17,009 more; repairs and maintenance of pipes and meters, which cost £35,307 more; discounts for gas used in large quantities, which increased by £3534; repairs and maintenance of works plant, which cost £5012 less; and rates and taxes, which cost £12,184 less.

The net cost of gas made and delivered during the past year shows an increase over the cost for the previous year of £89,145. Against that increased cost, there has been an increase in the revenue from the sale of gas amounting to £38,132. Here it will be noted that the revenue from the sale of gas has now reached the large figure of £2,000,000 per annum. The gross profit from the year's trading amounted to £579,678, being £50,361 less than the gross profit for the previous year. Interest on debentures and temporary loans absorbed £108,496, being £7008 more than for the previous year. The net profit for the year's trading amounted to £471,182, of which the contribution to the special purposes and depreciation fund has absorbed £193,000, being £12,811 more than for the previous year, and dividend has absorbed £324,204, being £20,888 more than for the previous year. The result, as before stated, has been that the "Carry Forward" has been reduced by £46,022.

The net revenue obtained from the sale of bye-products, £216,312, was £23,467 less than the revenue for the previous year. The total sales of gas during the past year amounted to 6,961,290,000 c.ft., an increase of 107,417,000 c.ft. over the sales for the previous year. The increase in the quantity of gas sold was only 1·56 p.ct., whereas the increase in the number of consumers supplied with gas during the year was 5·9 p.ct., the number of new consumers added during the year being 13,713, making the total at June 30, 245,733.

Extensions of mains and services totalling 74 miles and 59 miles respectively were laid during the past year, making the total mileage of mains 1961 and of services 2589.

The quantity of gas used for industrial purposes during the past year increased by 10·3 p.ct., totalling 436,646,000 c.ft., which is the equivalent of 6·27 p.ct. of the total gas sold. The scale of discounts for gas so used was extended during the past year for the purpose of inducing potential consumers of small quantities to adopt gas for the purposes of their business.

I now have pleasure in moving that the statement of accounts for the past year be received; that the report of the Directors be adopted, and that this meeting do order and determine that a dividend for the half-year ended June 30, 1929, be paid at the rate recommended therein—viz., 4 p.ct. [see "Journal" for Sept. 25, p. 690].

The motion, which was seconded by Mr. A. C. Stephen, the Deputy Chairman, was put to the meeting and carried unanimously.

On the motion of Mr. J. W. Holliman, an unanimous vote of thanks to the Directors and officers, for their efficient management of the Company's business during the past year, was carried by acclamation.

CHESTERFIELD GAS DEPARTMENT.

Increased Sales.

The carbonizing results of the Chesterfield Gas Department, which have been obtained from the horizontal retorts installed in 1924, are an improvement upon the figures of last year, and, having in mind the class of fuel used, which includes a fair proportion of slack and smalls, the figures are good. No serious renewals have as yet been required on this plant. The year's accounts show a substantial decrease in coal costs, which was, unfortunately, more than outbalanced by the serious drop in the value of coke and tar.

The sales of gas to quarterly consumers increased in volume and also in money value, but the use of gas through prepayment meters has been curtailed by 11·85 p.ct. The following net additional apparatus have been supplied and fixed for consumers during the year: Automatic meters, 168; gas fires, 393; gas cookers, 188; washing coppers, 372; and other appliances, 63. The new gasholder, sulphate of ammonia plant, and workmen's messroom were formally put into use on July 4, 1928, by Her Worship the Mayor; the Members of the Council, contractors, &c., being subsequently entertained at luncheon by the Chairman of the Gas Committee. During the year an 8-in. diameter steel main has been laid from the Chatsworth Road Works to Whittington Gas-Works, *via* the Highfields and Racecourse Building Estates. This main will serve as a high-pressure main for supplementing the supply of gas to these estates and for the automatic filling of the district holders at Whittington. During the year three miles, 1608 yards of additional gas mains have been laid, the total within the area of supply being 94 miles, 727 yards.

The method of charging for gas has been the subject of careful consideration during the early part of the year, and, on July 1, the scale at present in use was adopted. Based upon the fact that the more gas a consumer uses the cheaper each unit becomes, it should appeal to all users of gas and assist in developing sales.

INCREASED OUTPUT AT TRURO.

Competition of Foreign Tar.

The Annual Meeting of the Truro Gas Company was held on Sept. 26, and presided over by Mr. W. S. SITWELL, in the absence of the Chairman of Directors, Mr. Joseph Rogers, through illness.

The CHAIRMAN, moving the adoption of the Directors' report, said there were several notable features, and it must be gratifying to the shareholders to see that the Company was a really live concern. An increase of 3 million c.ft. in the quantity of gas sold last year was a record for the Company. Possibly they had been encouraged to activity by various elements of competition, and it was all to the good. The suspense account of £1451 had been wiped off altogether by drawing £200 from the renewals fund, which had been set aside to meet the cost of extensive renewals, and they had also made good the damage done by the explosion at the works in 1927. There was a loss on the sales of tar, due to the use of foreign materials in road-making. It seemed a pity that tar produced in Truro and within easy reach of roads, was replaced by foreign materials. Coal last year cost £300 less. On the net revenue account there was an increased profit of £350, and after paying dividends of 5 p.ct., on the preference stock and 6 p.ct. on the ordinary stock (an increase of ½ p.ct.) they would carry forward £2439.

Mr. S. J. INGRAM, Managing Director, seconding, said that they had created records during the past year, and in view of what they had passed through during the past four years it was satisfactory to find that they were still topping the high water mark of previous years. They were creating record after record, notwithstanding the fact that they had been faced with a public supply of electricity, which had been long overdue in Truro. The fact that they had sold 3 million c.ft. of gas more than in the previous year showed that gas still continued in popular favour, and was not so easily ousted as some people imagined. Another record had been the output of gas per ton of coal, but unfortunately they had also created a record in the other direction—a slump in the value of their residuals. But they had been able slightly to increase their profit, which enabled them to pay practically the maximum dividend authorized by their Act on the ordinary stock.

"CORNISH TAR FOR CORNISH ROADS."

Referring to the slump in residuals through the use of foreign materials, Mr. INGRAM said it seemed a shame that this country was a dumping ground for practically every foreign product. Road tar had dropped 2d. a gallon, and in common with other tar distillers, the Truro Gas Company had suffered. It was estimated that in Devon and Cornwall last year £120,000 was paid for imported bituminous products. He would press the slogan of "Cornish tar for Cornish roads," or "British tar for British roads." There was enough tar produced in this country to treat the whole of the British roads. They looked forward with a great deal of confidence to the future if they were permitted a fair field and no favour.

A vote of thanks was accorded the Directors and staff, on the proposal of Mr. J. H. MITCHELL, seconded by Mr. W. A. SANDOW.

Mr. R. J. WILLIAMS, Engineer, said they had a loyal staff. Every effort would be made to increase the sale of gas, and they were determined that the service of the Company to consumers should be second to none. He saw a great deal in Truro for the further development of gas. The social club for the employees would always be a monument to Mr. Leslie Ingram's period of service with the Company.

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

Apart from steam coals of all kinds, the market is irregular, and in some cases decidedly weak. There is still some shortage of tonnage, but the trouble is deeper than this, and there is no doubt the demand, especially for Durham coals, has gone off very considerably in the last few weeks. Buyers are holding off for next year, and the uncertainties regarding selling schemes, hours, and new wages agreements are doing a great deal of harm.

Steam coals seem to be immune, and Northumberlands are reported full of trade at 16s. to 16s. 3d. f.o.b. for best screened sorts. In Durhams, gas coals are an uncertain market. Wear Specials are fairly firm at 17s. 6d. f.o.b. Best qualities are quoted nominally at 16s. 6d. to 16s. 9d.; but these, with seconds at 15s. to 15s. 3d., are not too well supplied with orders for prompt positions. Coking coals are weak at 15s. to 16s., with cheap lots offering to those who can put in prompt boats. Durham bunker sorts are very quiet, with best qualities round 15s. 9d., and ordinary sorts plentiful at 14s. 6d. to 15s.

Gas coke is in good demand, and 23s. 6d. f.o.b. is quoted for shipment.

YORKSHIRE AND LANCASHIRE.

Business on export account is firmer, and the output seems more fully absorbed. Quotations for best hards on prompt account are slightly stronger. There is an increased inquiry for secondary sorts. The demand for coke-making slacks is not so strong; but rough slacks are in fairly active request. The demand for the best qualities of house coal is good; but other sorts are quiet. The inquiry for the surplus supplies of gas coal is slightly better.

The following are the Humber bunker and export prices (f.o.b. usual shipping ports):

South Yorkshire—Hards, Association, bunkers 19s. 3d., export 18s. to 18s. 6d.; screened gas coal, export 18s. to 18s. 6d.; washed trebles, export 18s. to 18s. 6d.; washed doubles, bunkers 18s. 9d., export 17s. 6d. to 18s.; washed singles, export 16s.; washed smalls, bunkers 16s. 3d., export 15s. 6d.; rough slack, bunkers 13s. 6d. to 13s. 9d., export 12s. 6d. to 13s.

West Yorkshire—Hartley's (f.o.b. Goole), bunkers 17s. 6d., export 17s. to 18s.; screened gas coal, export 18s. to 18s. 6d.; washed trebles, export 18s.; washed doubles, export 16s. 3d. to 16s. 9d.; washed singles, export 16s.; washed smalls, bunkers 15s. 3d., export 14s. 6d.; unwashed trebles, export 17s. 6d.; unwashed doubles, export 15s. to 16s.; rough slack, bunkers 13s. 6d., export 12s.; coking smalls, export 12s.

Derbyshire and Nottinghamshire—Top hards, bunkers 19s. 3d., export 18s. to 18s. 6d.; cobbles, bunkers 18s. 9d., export 17s. 6d. to 18s. 6d.; washed trebles, export 18s.; washed doubles, export 17s. to 17s. 3d.; washed singles, export 16s. to 16s. 6d.; washed smalls, bunkers 16s., export 14s. 6d.; unwashed doubles, export 16s.; rough slack, bunkers 14s. 3d. to 14s. 9d., export 12s. 6d.

Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, bunkers 17s. to 18s. 6d., export 16s. 6d. to 17s.; gas coke, export 23s. to 24s.; furnace coke, export 23s. to 24s.; washed steam, Goole (West Yorkshire), bunkers 17s. 9d.; Hull (West Yorkshire), bunkers 18s.; Hull (South Yorkshire), bunkers 18s. 3d., export 17s., per ton f.o.b.

MIDLANDS.

The markets are very variable. This is one of the effects of the long "Indian summer." Dilatory householders have not been spurred into buying as they usually are before October, and the relation between supply and demand has been distorted. But for the self-imposed control of the industry the position would certainly have been much worse. The way in which unbalancing has been corrected in some departments of the market has surprised those with long experience of the trade. The supply of slacks has afforded some striking examples of quick readjustment to unstable conditions.

Concerted action has been taken in the different coalfields with regard to raising prices with the advent of October. It has not been easy, however, to sell at the enhanced rates agreed upon in the absence of urgency to buy. Towards the end of September the market was temporarily stirred by orders which consumers were anxious to get through at the old prices. Large sizes of good quality were in brisk request. The October advances range from 10d. upwards.

A slight improvement in the industrial demand is becoming apparent. The upward movement in coke has not been arrested. This is the main reason assigned for a further advance of 2s. 6d. in forge and foundry pig iron.

CONTRACTS OPEN.

Gasholder.

The Llandudno Urban District Council invite tenders for the construction and erection of a spiral-guided gasholder in steel tank, with foundations. [See advert. on p. 54.]

Dividends Declared at Tamworth.—A meeting of the shareholders of the Tamworth Gas Light and Coke Company was held on Wednesday last, under the Chairmanship of Mr. Robert Neville. The Directors reported a profit for the year of £3226; and it was decided to pay a dividend for the half-year at the rate of 10 p.ct. per annum on the old shares, and 7 p.ct. on the new shares, *less* income-tax. It was stated that new automatic stoking machinery was being installed at a cost of about £3000.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Sept.* 30.

The prices of tar products continue steady as follows:
Pitch, about 47s. 6d. per ton f.o.b.
Creosote, for export, 6¾d. per gallon f.o.b.
Pure toluole, 2s. 3d. per gallon; solvent naphtha, 95/160, about 1s. 5d. per gallon; pure benzole, about 1s. 11d. per gallon; and pyridine bases, 3s. 9d. to 4s. per gallon.

Tar Products in the Provinces.

Sept. 30.

Markets for tar products generally remain steady.

The demand for pitch continues, and a fair amount of business has now been done on the basis of 47s. 6d. f.o.b. for delivery to the end of 1930.

The market for creosote remains unaltered.

Crude carbolic continues very firm indeed. 2s. 6d. is reported to have been paid for delivery to the end of the present year and 2s. 5½d. has been offered, and refused, for January/June next year.

The crystals market is still very firm. For immediate delivery manufacturers are asking 9½d. per lb., and for November/December 9d. to 9¼d. As far as next year is concerned, while in some cases manufacturers would very likely book at 7d., for small parcels they are asking 9d.

Water-white products are steady, without any considerable variation.

The average prices of gas-works products during the week were: Gas-works tar, 25s. to 30s. Pitch—East Coast, 47s. 6d. f.o.b. West Coast—(f.a.s.) Manchester, 42s. to 42s. 6d.; Liverpool, 45s. 6d. to 46s. 6d.; Clyde, 45s. 6d. to 46s. 6d. Toluole, naked, North, 1s. 7½d. to 1s. 8¼d. Coal-tar crude naphtha, in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 1s. 3d. to 1s. 3½d. Heavy naphtha, North, 1s. to 1s. 0½d. Creosote, in bulk, North, liquid and salty, 3¼d. to 3½d.; low gravity, 2d. to 2½d.; Scotland, 3¼d. to 3½d. Heavy oils, in bulk, North, 5½d. to 6d. Carbolic acid, 60's, 2s. 5d. to 2s. 6d. prompt. Naphthalene, £12 to £14. Salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

Benzole Prices.

The following are considered to be the market prices to-day:

	s. d.	s. d.	
Crude benzole . . .	0 10	to 0 11	per gallon at works
Motor ,, . . .	1 5	,, 1 6	,, ,, ,,
90 p.ct. ,, . . .	1 7	,, 1 8	,, ,, ,,
Pure ,, . . .	1 10	,, 1 11	,, ,, ,,

TRADE NOTES.

Beck & Co., Ltd.

From Messrs. Beck & Co., Ltd., of 130, Great Suffolk Street, S.E. 1, we have received a catalogue of the firm's special products in the shape of valves, meters, steam traps, &c.

James Gordon & Co., Ltd.

Messrs. Norman Hope & Partners, of 61, Wind Street, Swansea, have been appointed by Messrs. James Gordon & Co., Ltd., of Windsor House, Kingsway, London, W.C., as their representatives in South Wales.

Blakeley Gasholder for Ventnor.

The Ventnor (I.O.W.) Gas and Water Company have placed an order with Messrs. Firth Blakeley, Sons, & Co., Ltd., of Vulcan Iron Works, Church Fenton, for an entirely new double-lift gasholder, fitted with their patent ball-thrust spiral carriages, of a capacity of 127,000 c.ft.

Optical and Radiation Pyrometers.

It often happens, when the question of measuring high temperatures is under consideration, that the user is in doubt whether he should employ an optical or a radiation pyrometer. Assistance in making this decision will be gained from a new catalogue just issued by the Foster Instrument Company, of Letchworth, wherein the capacities and limitations of these two types of pyrometer are conveniently contrasted.

Moore Gas Generator for Kilmarnock.

The Corporation of Kilmarnock Gas Department have placed an order with Messrs. Andrew Barclay, Sons, & Co., Ltd., for a Moore patent gas generator, for which the exclusive manufacturing rights were acquired by that firm, as noticed in our columns recently. The generator to be supplied is to produce three-quarter million c.ft. of gas of 425 B.Th.U. per day, as well as a substantial supply of good coke and other residuals. This plant has been chosen by the Kilmarnock Corporation after exhaustive tests made by their Engineer on an existing Moore plant. The Corporation reserve the right to order a second plant of the same capacity on the same terms.

Transmuting Momentum into Rotary Motion.

Increased volume and speed of motor traffic, says Mr. John Muir, of 3, Arundel Street, Strand, W.C. 2, in a communication which we have just received from him, is having an inevitable effect on the lift of gas mains and the risk of leakage. The vibration set up by the normal rigid wheels of motor vehicles is enormous; and neither rubber tyres nor springs can remedy it. The cure, he maintains, is by transmuting momentum into rotary motion at its source—the centre of the wheels. "Since it passes the wit of man to make roads to suit the wheels, common-sense may prevail in making the wheels to suit the roads." Particulars of his device may be obtained from the above address.

Carron Gas Fires.

From the Carron Company, of Carron, Stirlingshire, we have received their new gas heating appliances catalogue for the coming season. The list includes all the firm's latest range of fires in attractive finishes to suit all kinds of furnishings, and two types of gas-heated steam radiators are also included. The increasing popularity of Carron gas fires is largely due to the careful and continued attention given to the various details essential to the production of a satisfactory gas fire. In all Carron fires the inlet tap or gas injector can be adjusted for thorough control of the admission of gas and air, while the burner is so arranged that it is entirely noiseless when lighted and gives a bright and cheerful flame, perfect in combustion, and highly efficient. In addition to circulating a comforting warmth, these fires draw the vitiated air from the room, thereby ensuring thorough ventilation. Should any of the internal parts be broken, they can easily be replaced without disturbing the body of the fire, by simply removing the fuel guard bar. Carron gas fires are tasteful in design, and are made in a large variety of attractive finishes as follows: Enamel, red brown; pearl grey; royal blue; chrome green; blood red; holly green; and old gold; and also in electro-bronze; armour-bright; ground and berlin black; also covered with rustless steel, brass, or copper.

A Fine Advertisement.

A new advertisement recently produced by Messrs. Radiation, Ltd., to herald the advent of the gas fire season, is a masterpiece of advertising skill. The letterpress points to the new gas fires with the "Beam" radiants, which bring greater health and comfort to the home, but it is the scene above which is the crowning achievement of the advertisement. This depicts a man sitting in an armchair before a fireplace reading; but instead of the usual grate, there falls away behind a beautiful countryside scene—with the cornfields on the hillside and a tiny village nestling in a wooded valley below—and shedding a warm and healthful light over all is the picture of a gas fire in the background in the place of the sun. The whole production draws attention to the fact that the new radiants throw out the short infra-red rays, which are the healthy rays which the sun gives off, and shows how the cheerful warmth of the sun in summer time can be brought into the home even in the depths of winter.

Gas Featured at a Bradford Exhibition.—The Bradford Corporation Gas Department are taking a chief part in a Cookery, Food, and Health Exhibition which is being held at the Olympia Hall, Bradford. The Department have a large and atractive stand. Cookers, fires, wash-boilers, and lighting equipment—and particularly the latest all-enamelled cookers with stainless taps—make an interesting display. Miss Tuxford is giving daily demonstrations in gas cookery, including the cooking of a full family dinner, on a slot-meter cooker, at a cost of one penny for gas. During the past two years 5428 Bradford housewives have secured gas cookers.

Deal and Walmer Gas Company Report.—The gas sold shows an increase of 2·42 p.ct., notwithstanding the introduction of electric light recently. The fittings department has shown good profits. The Directors are still on the lookout for acquiring suitable showrooms. The vertical retort plant continues to give satisfactory results, and mainly in consequence the price of gas for the current year has been reduced to 10d. per therm. After paying the dividend on the 6½ p.ct. preference stock, the Directors recommend a final dividend on the ordinary stock of 7½ p.ct. per annum. In consequence of an agreement of July 16, 1929, with Tilmanstone (Kent) Collieries, Ltd., having been ratified and carried into effect, Mr. G. J. W. Hodges, one of the Directors, has retired, and Mr. G. T. Hannaford, of Adelaide House, London, has been co-opted in his stead. The Chairman, Mr. G. C. Allen, having decided to retire after the General Meeting, it has been arranged to co-opt in due course Mr. G. W. Anderson as a Director. The Directors have allocated during the past year a further sum of £366 to the benefit fund created in the interests of the employees, making £566 in all carried to that fund.

The Ministry of Health have sanctioned a loan of £18,200 by the Chorley Gas Committee for a new gasholder.

The Thorncliffe Coal Distillation Company show a profit for the year of £11,290. The total amount available to be carried forward is £33,966.

The annual returns of Darwen's Borough Treasurer show that at the gas-works, where again there have been many renewals and improvements to the plant, close on £4000 was spent during the financial year. There was a profit on the year's working of over £5000.

Considerable inconvenience was caused in Largs on Sept. 21 by the failure of the electricity supply for over an hour. Many streets and shops were in darkness, as also was the entertainments pavilion, where the final performance of the season was being given. Candles were used until the current was again available.

After April next consumers of gas at Blackpool will pay by the therm, and not by the cubic foot, bringing the town into line with other Boroughs. The Blackpool Gas Committee have decided to apply for a loan of £6000 for additional street lamps and for fitting lamps with automatic controllers. Arrangements for a new showroom for gas appliances were considered, and it was decided to apply for a loan of £10,000 for this purpose.

STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr	Dividends. Last Hf. Yr.	NAME.	Quotations. Sept. 27.	Rise or Fall on Week.	Transactions Lowest and Highest Prices.
£			%p.a	% p.a.				
171,978	Stk.	Aug 15	5	5	Aldershot 5 p.c. max. C.	70—75	..	..
412,992	,,	..	4	4	Do. 4 p.c. Pref.	73—76	..	..
1,651,848	,,	Sept. 26	7½	7½	Alliance & Dublin Ord.	94—97*	—2	..
274,000	,,	July 11	4	4	Do. 4 p.c. Deb.	62—65	..	..
522,655	,,	Aug. 29	7	7	Barnet Ord. 7 p.c.	112—115	..	..
800,000	1	May 9	1/4⅜	1/4⅜	Bombay, Ltd.	1/2—1/2	—1/32	17/6—18/-
172,500	10	Aug. 29	8½	9	Bournemouth 5 p.c.	122—132	..	12½—13½
500,000	10	,,	7	7	Do. B 7 p.c.	12½—12⅝	..	12⅜—12½
439,160	10	,,	6	6	Do. Pref. 6 p.c.	10½—11	..	..
50,000	Stk.	July 11	8	8	Do. 8 p.c. Deb.	54—57	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	72—75	..	..
357,900	,,	Aug. 29	7½	7½	Brighton & Hove 6 p.c. Con.	113—116	..	..
271,880	,,	,,	6⅔	6⅔	Do. 5 p.c. Con.	100—103	..	..
1,387,509	,,	July 25	5	5	Bristol 5 p.c. max.	89—90a	..	..
885,000	,,	Sept. 12	7½	7	British Ord.	115—118*	..	115½
100,000	,,	June 27	7	7	Do. 7 p.c. Pref.	112—117	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	71—74	..	..
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb.	94—97	..	96½
180,000	10	May 30	6	8	Cape Town, Ltd.	9—10	..	..
180,000	10	Apl 24	4½	4½	Do. 4½ p.c. Pref.	6¾—7½	..	..
150,000	Stk.	June 27	4½	4½	Do. 4½ p.c. Deb.	71—76	..	..
696,860	,,	July 25	6	6	Cardiff Con. Ord.	98—101	..	..
187,840	,,	June 27	7½	7½	Do. 7½ p.c. Red. Deb.	99—102	..	..
187,150	,,	Aug. 15	6½	5	Chester 5 p.c. Ord.	87—92b	+1	..
98,936	1	May 9	1/3/-	1/3/-	Colombo Ltd. Ord.	35/—37/-	..	..
94,495	1	,,	1/4⅛	1/4⅛	Do. 7 p.c. Pref.	20/—22/-	..	..
375,402	1	Apl. 11	1/9⅛	1/9⅛	Colonial Gas Assn. Ld. Ord.	24/6—26/6	..	..
187,848	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	21/—23/-	..	..
3,073,380	Stk.	July 25	7	5	Commercial Ord.	93—96	..	93½—94
476,000	,,	June 13	8	8	Do. 8 p.c. Deb.	56—59	..	..
787,560	,,	Aug. 15	7	7	Croydon sliding scale	105—110	—2	105—107
400,100	,,	,,	5	5	Do. max. div.	81—84	..	82½—83
542,270	,,	Aug. 29	10	7	Derby Con.	118—121e	..	..
85,000	,,	June 27	4	4	Do. Deb.	68—71e	..	..
400,000	,,	Aug. 29	5	5	East Hull Ord. 5 p.c.	73—75	..	..
1,009,180	10	Sept. 12	17	14	European, Ltd.	15½—17½	—½	15½—16½
10,706,480	Stk.	July 25	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	17/6—18/-f	—/3	17/6—18/-
2,200,000	,,	,,	6¼	6¼	Do. 6¼ p.c. max.	61—63	..	61—62½
4,137,000	,,	,,	4	4	Do. 4 p.c. Con. Pref.	70—73	—2½	71—74
5,500,000	,,	June 13	3	3	Do. 3 p.c. Con. Deb.	55—58	..	56—56½
9,649,770	,,	,,	5	5	Do. 5 p.c. Red. Deb.	97—100	..	98½
68,500	,,	Aug. 29	7	7	Hastings & St L. 5 p.c. Conv	98—103	..	..
988,740	,,	,,	5½	5½	Do. 5½ p.c. Conv.	77—82	..	..
70,000	10	Apl. 24	†10	†10	Hongkong & China, Ltd.	14—15	..	14½—14⅝
312,800	Stk.	Aug. 29	6	6½	Hornsey Con. 6½ p.c.	84—87	..	..
1,970,000	,,	May 30	10	20	Imperial Continental Cap.	385—405	—5	385—419
328,180	,,	Aug. 15	8½	8½	Do. 8½ p.c. Red. Deb.	70—75	+2	75
825,242	,,	Aug. 15	7½	8	Lea Bridge 5 p.c. Ord.	115—118	..	..
9,145,907	,,	Aug. 15	6½	6	Liverpool 5 p.c. Ord.	93½—94½b	+½	..
800,000	,,	Sept. 26	7	7	Do. 7 p.c. Red. Pref.	99—101b*	—3	..
168,786	,,	Aug. 29	8	9	Maidstone 5 p.c. Cap.	122—127	..	..
63,480	,,	June 27	8	8	Do. 8 p.c. Deb.	53—56	..	..
70,000	8	June 13	†8	†10	Malta & Mediterranean	5½—6	..	..
892,000	—	Apl. 2	—	5½	Melrop'tn (of Melbourne) 5½ p.c. Red. Deb.	93—101	—½	93½—99
941,930	Stk.	May 30	†5	†9	Montevideo, Ltd.	105—108	..	..
2,041,818	,,	July 25	5⅝	5	Newcastle & Gateshead Con.	17/—17/6d	..	..
682,356	,,	,,	4	4	Do. 4 p.c. Pref.	71½—72½d	..	..
691,705	,,	June 27	8½	8½	Do. 8½ p.c. Deb.	68—69d	..	..
131,780	,,	Aug. 29	7/1/0	7½	North Middlesex 6 p.c. Con.	110—115	..	..
200,000	,,	Apl. 24	9	7	Oriental, Ltd.	113—118	..	115
205,162	,,	June 27	8	8	Plym'th & Ston'house 5 p.c.	110—113	..	..
424,416	,,	Aug. 29	8½	8	Portsm'th Con. Stk. 4p.c. Std.	113—118	..	..
241,446	,,	,,	5	5	Do. 5 p.c. max.	80—83	..	..
2,884,464	1	June 27	—	†5	Primitiva Ord.	31/—33/-	—1/-	31/6—33/9
244,500	100	June 3	4	4	Do. 4 p.c. Red. Deb.	92—95	..	..
695,000	Stk.	July 25	4	4	Do. 4 p.c. Red. Deb. 1911	79—82	..	..
416,345	,,	June 27	4	4	Do. 4 p.c. Cons. Deb.	79—82	..	81—81½
150,000	10	Sept. 26	6	6	San Paulo 6 p.c. Pref.	8½—8⅝*	—¼	..
1,736,968	Stk.	Mar. 21	6½	6½	Sheffield Cons.	108—110a	..	..
95,000	,,	Jan. 10	4	4	Do. 4 p.c. Deb.	74—77a	..	..
90,000	10	June 13	‡4	‡4	South African	4—6	..	..
6,909,895	Stk.	July 26	7½	5	South Met. Ord.	98½ 100½	—1	99—100⅝
500,000	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	106—109	..	..
1,895,448	,,	July 11	3	3	Do. 3 p.c. Deb.	54—57	—1	54—56
784,000	,,	Sept. 12	6½	6½	Do. 6½ p.c. Red. Db.	98—100*	..	..
91,500	,,	Aug. 15	8½	8½	South Shields Con.	103—104d	..	..
1,543,795	,,	July 25	6½	6½	South Suburban Ord. 5 p.c.	102—105	—1	104
468,887	,,	June 27	5	5	Do. 5 p.c. Deb.	95—98	..	..
847,740	,,	Aug 15	5	5	South'mpton Ord. 5 p.c. max	77—80	..	..
121,275	,,	June 27	4	4	Do. 4 p.c. Deb.	70—73	..	..
179,014	,,	July 25	8	8	Sutton Ord.	116—119	..	..
67,328	,,	June 27	5	5	Do. 5 p.c. Deb.	90—93	..	..
350,000	,,	Feb. 21	7	7	Swansea 7 p.c. Red. Pref.	100—102	..	..
900,000	,,	June 27	6½	6½	Do. 6½ p.c. Red. Deb.	100—102	..	..
1,002,275	,,	Aug. 15	6⅔	6⅔	Tottenham District Ord.	105—108	..	107
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	97—100	..	..
151,355	,,	June 13	4	4	Do. 4 p.c. Deb.	74—77	..	..
289,094	,,	Aug. 29	7	7	Uxbridge, Maidenhead, & Wycombe 5 p.c.	93—98	..	..
82,280	,,	,,	5	5	Do. 5 p.c. pref.	55—60	..	..
80 000	,,	July 11	9	9	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	140—145	..	..
355,636	,,	,,	7½	7½	Do. B 5½ p.c.	117—122	..	..
422,685	,,	,,	6.75	6.75	Do. C and New	98—103	..	..
852,900	,,	,,	7½	7½	Do. Wimbledon 5 p.c.	110—115	..	..
98,000	,,	,,	7⅝	7⅝	Do. Epsom 5 p.c.	118—123	..	..
200,000	,,	,,	5	5	Do. 5 p.c. Pref.	87—92	..	..
88,416	,,	June 27	3	3	Do. 3 p.c. Deb.	54—57	..	..
284,743	,,	,,	4	4	Do. 4 p.c. Deb.	74—77	..	..
207,500	,,	,,	5	5	Do. 5 p.c. Deb.	93—96	..	..

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *s.*—Sheffield. *f.*—The quotation is per £1 of Stock. * Ex. div. † Paid free of income-tax. ‡ For year.

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NEW "THOMPSON"
BOILERS
EX STOCK.

MOST MODERN "DISH-END" TYPE
WITH CORRUGATED SECTIONS.

	W.P.	Shop No.
One 30 ft. by 9 ft. 3 ins. by	200 lbs.	6815
One 30 ft. by 9 ft. 3 ins. by	180 lbs.	6862
Two 30 ft. by 9 ft. 3 ins. by	160 lbs.	6848/9
One 30 ft. by 8 ft. 6 ins. by	120 lbs.	6812
One 30 ft. by 8 ft. 6 ins. by	160 lbs.	6826
Two 30 ft. by 8 ft. 3 ins. by	160 lbs.	6871/2
One 30 ft. by 8 ft. 0 ins. by	180 lbs.	6574
One 28 ft. by 7 ft. 6 ins. by	160 lbs.	6785

All the above Boilers are built from "Siemens Martin" Acid Steel.

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Repairs to all types of Boilers by first-class men.

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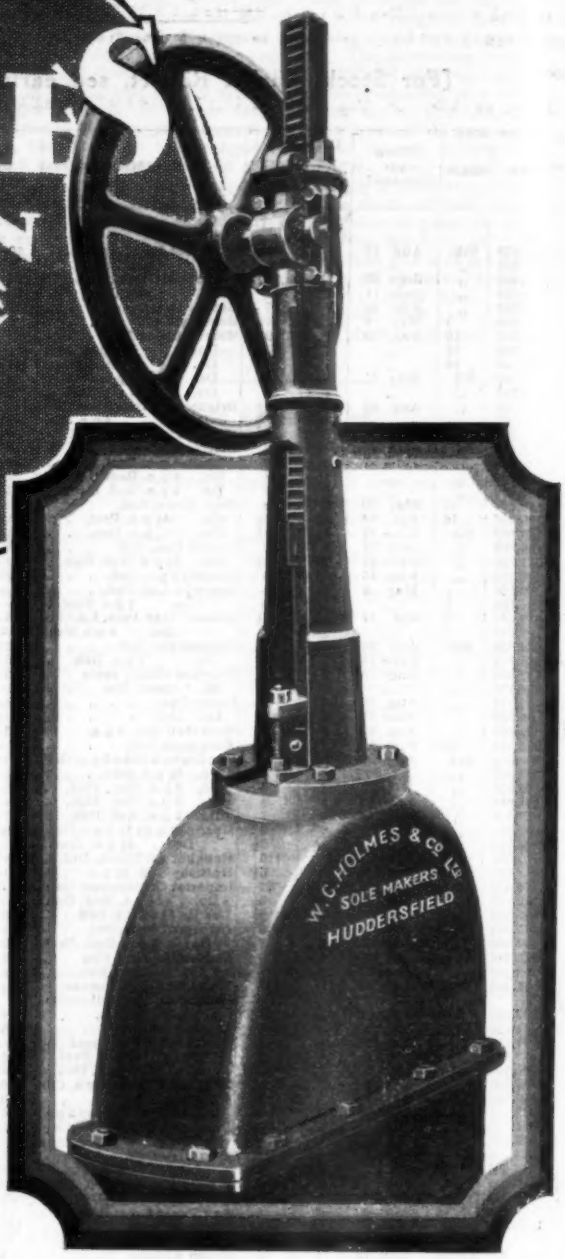
The HOLMES WESTERN DOUBLE FACED VALVE



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The photograph shows a new type of quick opening valve which we have recently introduced, which is particularly suitable for use on Purifiers and other apparatus where quick opening is essential. The valve is easily operated and controlled by one man, and may be locked in any position. The position of the steel rack indicates at once whether the valve is open or shut.

The absolute reliability for tightness and ready access to the interior of the valve whilst it is in use, which are the well-known and unique features of the Holmes' Valve, are embodied in this design.

Recent Orders for Purifier Valves:—
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The "GAS SALESMAN" is included as a supplement to the "JOURNAL" eighteen times a year—twice a month from October to March, and once a month from April to September. Additional copies are also obtainable at the following rates: Annual Subscription 6/-, post free, payable in advance. Single copies (by post) 4½d. In Bulk for Distribution among Gas Service Staffs—100 copies of each issue, 30/-; 50 copies, 16/-; 25 copies, 8/-; 12 copies, 4/-, all plus carriage.

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(See also advertisement, Centre p. VIII.)

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for
GAS-METERS, ORDINARIES, SLOTS, AND REPAIRS

Foleshill Road, Coventry.
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Certus Works, Kingston Road, Raynes Park, London, S.W. 20.
Radium Works, 12, Radium Street, Oldham Road, Manchester.

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SPECIALLY prepared for the manufacture of SULPHATE OF AMMONIA.

SPENCER CHAPMAN & MESSEL, LTD.,
with which is amalgamated Wm. Pearce & Sons, Ltd., 38, Mark Lane, London, E.C. Works—Silvertown.
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FOR Motor Lorries and Railway Traffic can be seen erected at our Works READY FOR DELIVERY. Inspection by your Engineer invited and a test by your Local Inspector of Weights and Measures before delivery. Every machine a High-Class Engineering Product and fully guaranteed.

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(See illustrated page advert. Centre p. XI., Sept. 25).

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FIRTH BLAKELEY, SONS, & CO., LTD., CHURCH-FENTON, YORKSHIRE.

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SITUATION Wanted by a Works Clerk, experienced in Wages, Costing, Stores, &c. Reliable and trustworthy. Excellent References. Many years with the South Metropolitan Gas Company.
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MANUFACTURERS of Patent "C.P." Diaphragm are desirous of appointing an AGENT, or would be willing to arrange with an Established Firm to MANUFACTURE and MARKET under License, or to IMPORT in a knock-down state for assembling and marketing.
Representation in New Zealand already provided for.
Apply, JOYMANCO (BRIGHTON), LTD., CAMBRIDGE GROVE, HOVE, ENGLAND.

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ENGINEERING Assistant. — Fully- Qualified Man, Experienced in Mechanical Engineering, Vertical Retorts, and General Gas-Works Practice, WANTED FOR EARLY APPOINTMENT.
Applications, stating Age, Experience, Training, also Salary required, to be sent to the undersigned on or before Monday, Oct. 7, 1929.
GEO. P. MITCHELL, M.I.Mech.E.,
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CORPORATION OF CALCUTTA.

APPOINTMENT OF LIGHTING SUPERINTENDENT.

APPLICATIONS are invited for the Post of LIGHTING SUPERINTENDENT, Calcutta Corporation. The Salary of the appointment is Rs. 750/-, rising to Rs. 1,000/- per month by annual increments of Rs. 25/- for approved service *plus* a Motor Car allowance of Rs. 100/- per month. The Corporation will be prepared to pay any Salary within the grade to a particularly qualified candidate.

There are at present 18,000 incandescent gas lights, about 10,000 electric lights, including those in Municipal buildings, besides a number of oil lights. Additions are being made every year. Gas and electricity are supplied by public companies; but the Corporation are considering the question of providing their own electric generating station. The Lighting Department of the Corporation are responsible for the maintenance of the public street lamps and also of about 3,000 lights and 800 electric fans in Municipal Buildings.

Candidates must have recent experience of street lighting by gas in a large city with a thorough and up-to-date knowledge of mantles, burners, &c., photometric work, testing pressure, gas analysis, calorific value, and determining the discharging capacity of burner nipples. Candidates must also have similar knowledge of street lighting by electricity and of the working of generating station and possess certificates from recognised institutions or large Municipalities that they possess a thorough knowledge of street lighting by gas and electricity and are capable of managing and controlling the Lighting Department of a large city.

The appointment is subject to the Provident Fund, Leave, and other Service Rules of the Corporation and may be terminated at any time by three months' notice on either side. The Provident Fund contribution is 8⅓ per cent. of the monthly salary and an equivalent amount is added by the Corporation, and the fund accumulates at compound interest. The selected candidate will be required to devote his whole time to the duties of his office and will not be allowed to take up any outside work. He will be liable to removal during the term of his office for misconduct or neglect of or incapacity for his duties. He will be required to submit to a medical examination and produce a certificate of physical fitness before joining his appointment. If a candidate is selected outside India, the Corporation will pay his passage (1st class) from London to Calcutta and also half pay for the period occupied by the journey, but he must refund the amount paid for passage if he gives notice within two years from the date of taking up his appointment. He will be required to take up his appointment about the 1st March, 1930.

Candidates should state their Age and Experience. In case a candidate is related to the Mayor, or any Alderman or Councillor or any Statutory Officer of the Corporation, he should notify such relationship in his application.

Applications will be received by the Secretary to the Corporation of Calcutta, Central Municipal Office, Calcutta, up to Friday, the 15th November, 1929.

B. V. RAMIAH,
Secretary to the Corporation.

Central Municipal Office,
The 11th September, 1929.

PLANT &c., FOR SALE & WANTED.

PLANT FOR SALE.

PURIFIERS.—Dry Lute Type. One Set of Four, 10 ft. square; One Set of Two, 10 ft. square; and One Set of Two, 8 ft. square, with Lifting Gear Valves, &c.

Meters.—Two Rectangular Station Meters fitted with New Drums, 15,000 c.ft. per hour capacity. Cylindrical Station Meters, 10,000, 4000, 3600, and 2000 c.ft. capacities and smaller.
Station Governors.—Parkinson, Cowan, and Peebles, 4 in., 6 in., and 8 in.
Retort Ironworks for beds of 4's, 5's, 6's, 7's, and 8's. 22 in. by 16 in. Self-Sealing Mouthpieces. 6 in. Ascension Pipes and all to follow.
Washers and Tar Extractors—Livesey and Cripps type. 2 million, 500,000, 400,000, 250,000, 200,000, and 150,000 c.ft. per day capacity.
Holmes Brush Washer Scrubber.—250,000 per day. Valves, Connections, &c., complete.
Exhausting Sets.—Steam and Gas Engine-driven, 5000 to 40,000 c.ft. per hour capacity.
Storage Tanks. — Large number in Stock (Rectangular and Cylindrical). Tar Stills, &c.

Tar and Liquor Pumps, Steam and Belt-Driven.
Air Receivers, Fans, Blowers, Valves, Rivetted Tubes.

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(Second-Hand Plant Dept.),
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GAS-WORKS Plant. We Purchase, for Dismantling, for Re-Use or Scrap, any DISCARDED PLANT or IRONWORK. Best prices, prompt removal by experienced staff, covered by insurance for all risks.
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GASHOLDER, 40 ft. dia. by 20 ft., of 25,000 c.ft. capacity, with Cup for Outer Lift and Steel Tank. Outer Lift could be supplied to make capacity 50,000 c.ft.
FIRTH BLAKELEY, LTD., CHURCH FENTON, LEEDS.

65 B.H.P. GAS ENGINE, Direct Coupled to 220 v. D.C. 43 KW. Generator, complete with Switchboard.
Apply, BAGSHAWE & CO., LTD., DUNSTABLE.

TAR Tank-Wagons. — Several Ten- Tonners available, Rectangular Type, for SIMPLE HIRE. Midland District.
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FOR HIRE—Several 14-ton Cylin-drical Steam Coil RAIL TANK-WAGONS, suitable for Tar, Creosote, &c.
Address, No. 7994, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

CONTRACTS OPEN.

SUTTON-IN-ASHFIELD URBAN DISTRICT COUNCIL.
(GAS COMMITTEE.)

TENDERS.

THE Gas Committee of the above Council invite TENDERS for the following:

1.—For the RE-CONSTRUCTING and RE-MODELLING of the existing COAL-HANDLING PLANT serving the Inclined Retort House and Carbonizing Plant at their Gas-Works.
2.—For the Repairing of the existing small GASHOLDER at their Gas-Works.
3.—For the Erection of a NEW GASHOLDER on the site of the existing small Holder.

Specifications can be obtained on Application to the Council's Gas Engineer and Manager, Mr. J. J. Merrell, Council Offices, Forest Lodge, Station Road, Sutton-in-Ashfield.

The Council do not bind themselves to accept the lowest or any Tender.

Tenders, endorsed "Tenders," to be sent so as to reach me not later than Tuesday morning, the 8th day of October, 1929.

By order,
LUTHER PEPPER,
Clerk to the Council.

Portland Square,
Sutton-in-Ashfield,
Sept. 20, 1929.

LLANDUDNO URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TENDERS are invited for the Con-struction and Erection of a SPIRAL-GUIDED GASHOLDER in STEEL TANK, with FOUNDATIONS, at the Gas-Works, Llandudno.

Copy of General Specification and Conditions can be obtained from the Gas Manager, Gas Offices, Town Hall, Llandudno.

Tenders, addressed to the Gas Manager, Gas Offices, Town Hall, Llandudno, endorsed "Tender for Gasholder," to be received not later than 10 a.m. on the 16th of October, 1929.

The Committee do not bind themselves to accept the lowest or any Tender.

H. DUXBURY,
Engineer and Manager.

Gas Offices,
Town Hall,
Llandudno.

EDUCATIONAL.

THE GAS COLLEGE, HALIFAX.

UNDER the new Regulations (1929) of the "Chartered Institution," External Candidates for the profession may obtain Training in all the subjects specified when, where, and how they please.

The Courses of the "College" have been re-organized and extended to cater for all the requirements of Students in respect of both the main and the ancillary subjects.

Full particulars of these will be forwarded on application to the PRINCIPAL, THE GAS COLLEGE, 3, THRUM HALL LANE, HALIFAX.